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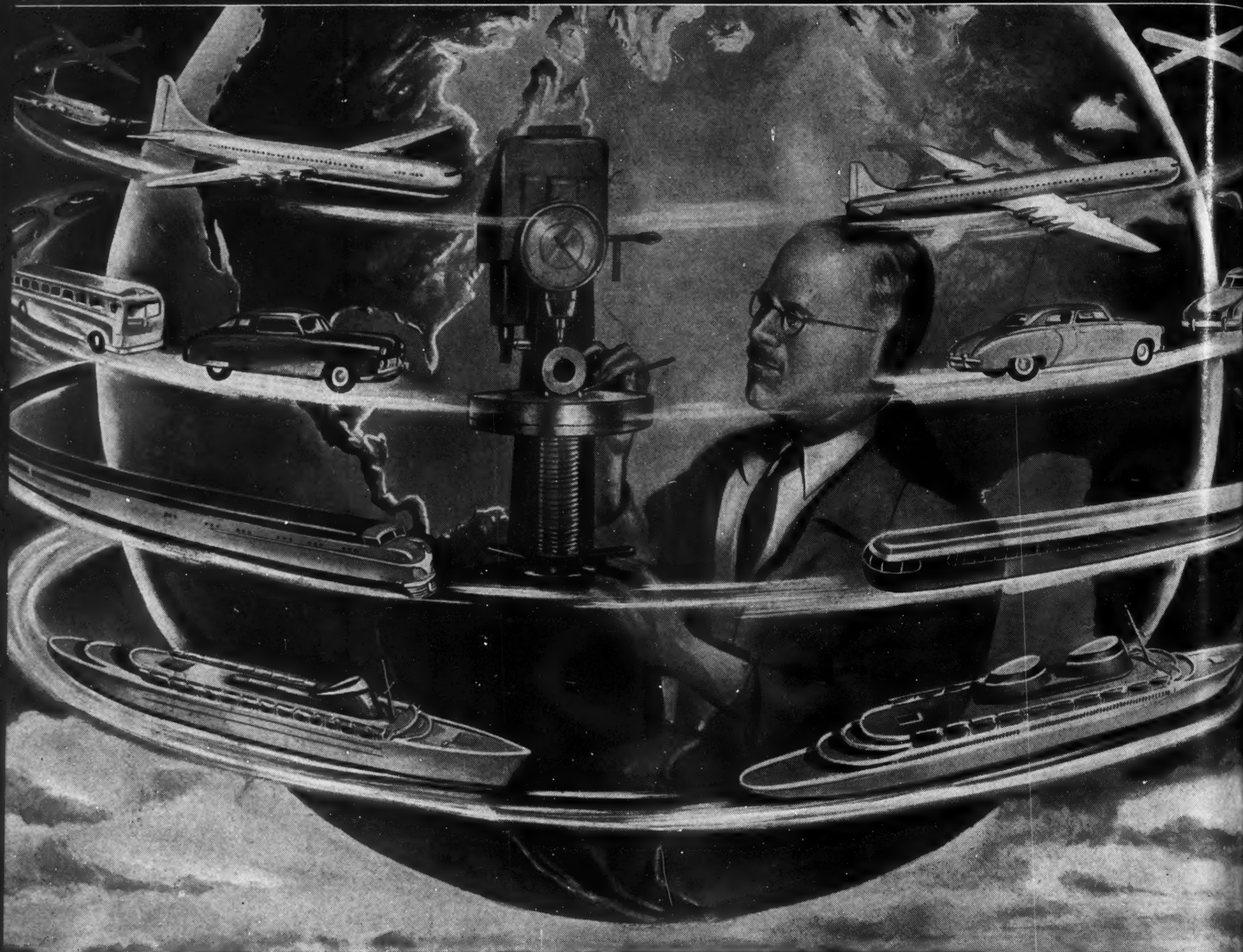
COLLEGE OF ENGINEERING · CORNELL UNIVERSITY

"—Many shall run to and fro, and knowledge will be increased" —DANIEL XII, 4.



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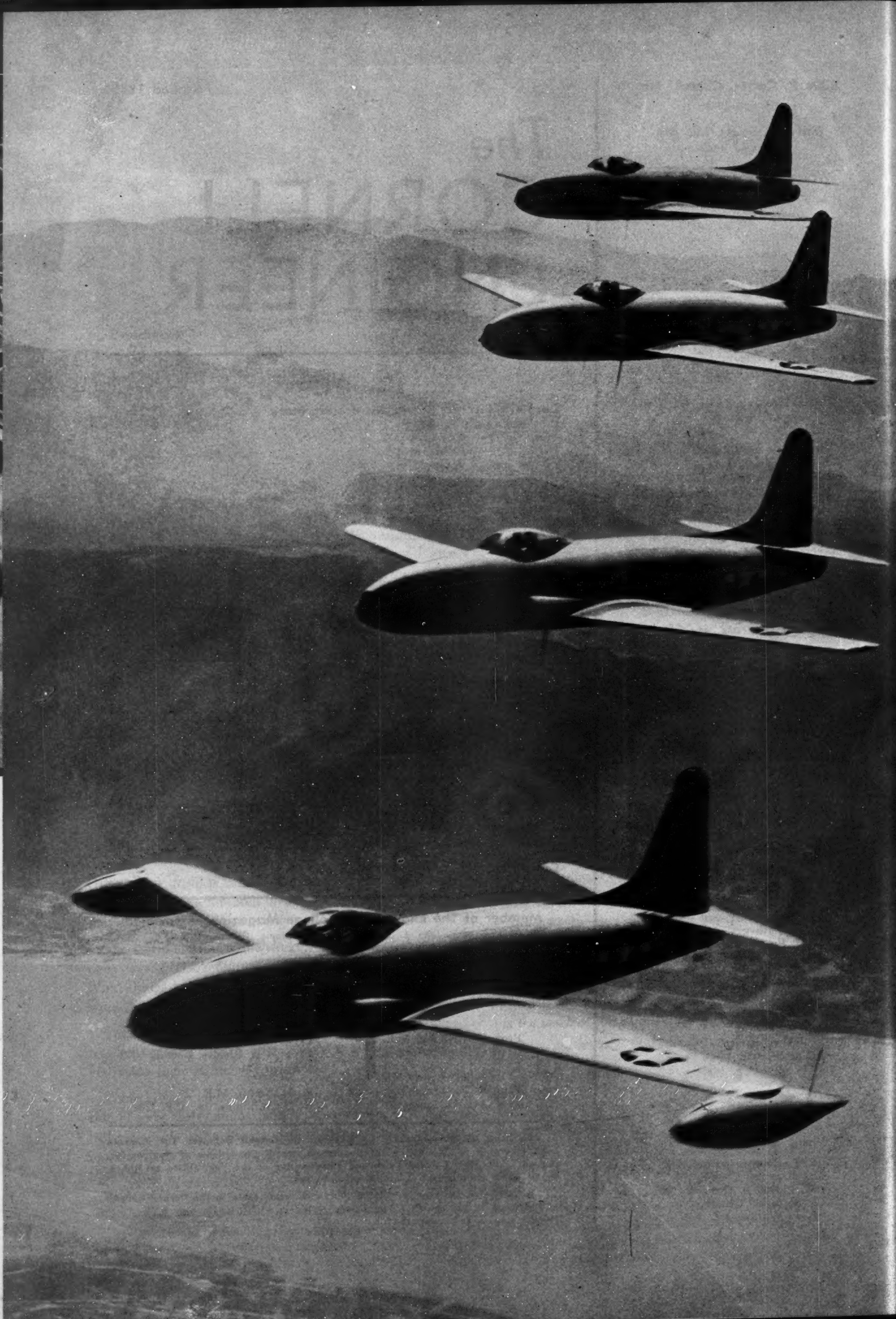

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Cornell's Aircraft Powerplants Laboratory

By I. KATZ
Assistant Professor of Mechanical Engineering

IN relatively few years aviation has extended our concepts of physical communication. It has brought about a more desirable proximity of producer and consumer, opened new markets, shrunk the globe in terms of time and distance, and brought home in no uncertain terms the diabolical nature of warfare and the advisability for world peace.

The aircraft powerplant largely determines, and in a sense limits, the direction and degree of progress in aviation. Mr. Leonard Hobbs of United Aircraft estimates that increased engine power-output accounts for 75% of the aircraft speed-range increment during the past 30 years, and that the remaining 25% can be attributed to advances in aerodynamic design.[1] Size, speed, endurance, economy, and reliability of aircraft mainly reflect the characteristics and attributes of their propulsion machinery.

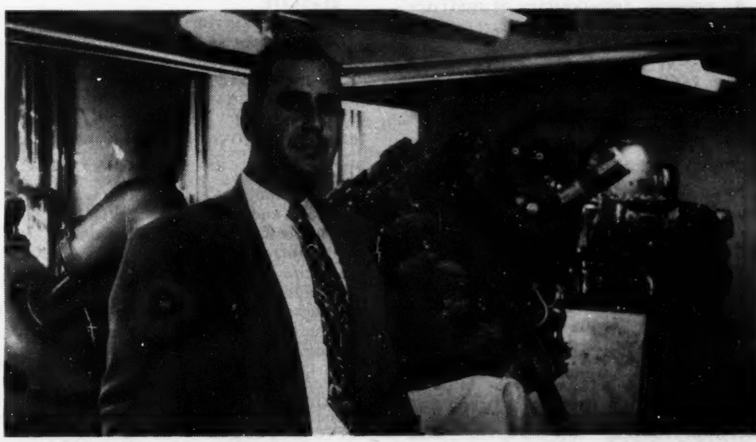
As an expression of their faith in aviation and in anticipating the widespread use of aircraft for commercial transportation and personal travel, a large industry and a new field of engineering endeavor are now being developed to conceive, improve, build, and operate tomorrow's aircraft.

Even today, the aircraft industry occupies a prominent position in the American industrial scene, and air transport is a significant factor in the over-all transportation picture.

In recognition of the sound and promising nature of aviation, the College of Engineering at Cornell University, as other progressive technical institutions have already done, has undertaken part of the responsibility to offer instruction in this growing field. The Graduate School of Aeronautical Engineering, established in 1946, offers advanced study to those who are principally concerned with the aerodynamic

Four P-80 Lockheed "Shooting Star" jet planes powered by G-E designed I-40 aircraft gas turbines.
—Courtesy General Electric Co.

THE AUTHOR



Graduating with honors from Northeastern University, Professor Israel Katz subsequently completed General Electric's Mechanical Design Course and did graduate work at MIT in naval architecture and at Cornell in mechanical engineering.

During the war he instructed in the Naval Diesel School at Cornell, later teaching Aircraft Engine Design in the Naval Aeronautical Option in M.E. and graduate extension courses in Heat Transmission at the Westinghouse Electric Co.

Since 1946, Professor Katz has been a member of the Consulting Engineering Group of the Pratt & Whitney Aircraft Company.

He holds the degrees of BSME and MME, is a member of Tau Beta Pi, a junior member of ASME and the Society of Automotive Engineers, and an associate member in the Society of Naval Architects and Marine Engineers.

1. "American Aircraft Propulsion Machinery" by W. J. King, Director of Sibley School of Mechanical Engineering at Cornell, and W. R. Hawthorne, Professor of Aero Gas Turbines at M.I.T., Institution of Mechanical Engineers, London, England, June 1947.

and structural aspects of aircraft, and to those who are chiefly interested in the fluid-mechanical problems of aircraft powerplants.

Courses in areodynamics and gasdynamics, which are of major interest to students in the Sibley School, are available in the Graduate School of Aeronautical Engineering.

The work to be carried on in the new Aircraft Powerplants Laboratory of the Sibley School of Mechanical Engineering at Cornell will serve as the nucleus for a broad program of instruction, both on undergraduate and graduate levels, in matters devoted to the development and perfection of aircraft propulsion machinery.

Two Courses Exit

At present, two courses of instruction are given in aircraft powerplants at Sibley on an elective basis. 3660, "Principles of Aircraft Powerplants," is a descriptive course dealing with the principles of operation, physical components, accessory equipment, and performance characteristics of contemporary piston engines and the newer aeronautical gas turbine powerplants, such as the jet-engines and turbo-props. This course is open to all Mechanical Engineering students, other than freshmen. 3661, "Aircraft Engine Design" is a detailed study of the thermodynamic, dynamic, and structural aspects of piston engine design. This is an advanced course and is open to qualified ME upperclassmen. Additional courses such as 3662—"Aircraft Powerplants Laboratory," 3663—"Aircraft Engine Design—Advanced," 3664—"Aeronautical Gas Turbines," 3665—"Experimental Projects," and 3666—"Aircraft Powerplants Seminar," may be offered in the future to complete the program of instruction. The Aircraft Powerplants Laboratory will be integrated into this program; it is to furnish the physical facilities for laboratory and experimental work so essential to the effective teaching of development and experimental techniques.

Present plans call for three distinct, but complementary, activities in the laboratory, such as:

1. Instruction—Undergraduate and graduate.
2. Student Experimental Projects— Undergraduate and graduate.
3. Industrial Experimental Projects—Graduate and faculty.

Laboratory instruction is intended fo cover the following aspects of the aircraft powerplant:

1. Contemporary engine design.
2. Fuels and Combustion problems.
3. Engine design and combustion.
4. Bearings and lubrication.
5. Engine accessories and auxiliary equipment.
6. Engine instrumentation.
7. Engine performance testing.
8. Engine accessories testing.

It is hoped that supervised individual-experimental-projects will serve to engender originality and creative effort on the student's part. In some cases the projects may serve as bases for original papers or theses; in other instances students may select or be assigned to projects, sponsored by some industrial firm, to instruct them in industrial procedures and techniques.

Equal Opportunities

Faculty members and graduate students alike may share the opportunities to pursue experimental, development, or research projects sponsored by some industrial agency. Work of this nature is valuable and desirable as it not only meets the needs of industry, but also serves to bring the factulty and students in touch with practical problems, industrial trends, and current practice. It also serves to promote technical competence in faculty and students, affords a proving ground for young engineers, and if wisely administered furnishes a source of revenue to meet the costs of laboratory operation. Active cooperation between an engineering institution and industry should benefit all concerned.

The physical plant of the Cornell Aircraft Powerplants Laboratory is now under construction at the East Hill Airport, which is located about three miles northeast of the campus. When completed, the laboratory will cover an area of approximately 18,400 square feet and consist of two interconnected buildings. The smaller of the two buildings 24′ x 100′ was purchased by the University. The larger building 100′ x 165′ was granted to the University by the War Assets Administration; the grant covers the cost of the building, its erection, and the internal construction necessary to meet the needs of an aircraft powerplants laboratory such as test-cells, special piping, and special electric wiring.

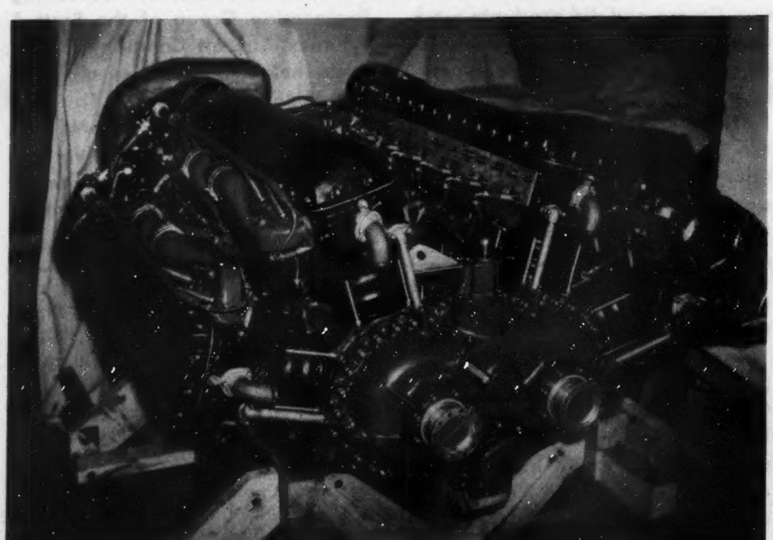
Principal Divisions

The principal activities will be carried on in special areas assigned to them, the major areas being broken down as follows:

I. Laboratory Instruction:

1. Aircraft engine instrumentation, testing, and calibration.
2. Engine component study and display.
3. Engine accessories study and display.
4. Engine accessories testing.
5. Carburetion studies.

Latest Double Allison 3420 to be used for test purposes.



6. Ignition studies.
7. Bearing and lubrication studies.
8. Combustion studies.
9. Fuels and detonation studies.
10. Engine dynamics.
11. Engine cooling.
12. Engine performance testing.
13. Engine supercharging studies.
14. Aeronautical gas turbine studies.
15. Library and desk facilities.
16. Classroom space.

II. Experimental Work:
1. Combustion
2. Engine dynamics
3. Engine structures
4. Erection areas
5. Air-cooled engine test facility.
6. Liquid-cooled engine test facility.
7. Jet-engine test facility.
8. Engine component test facilities.

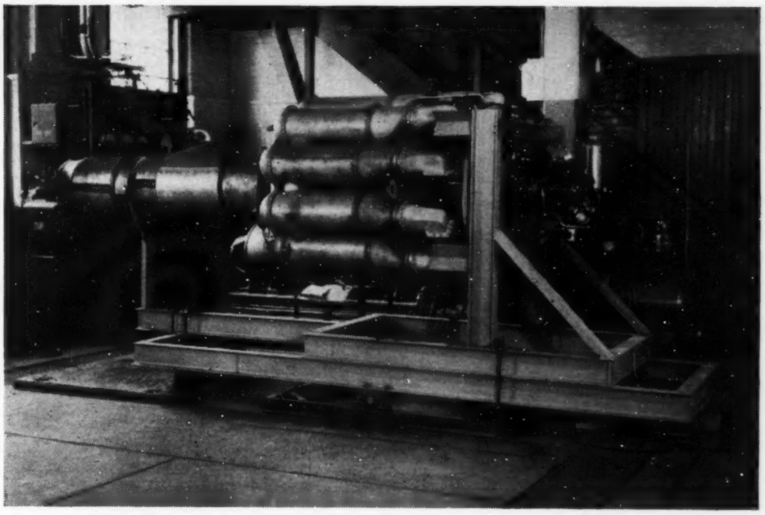
III. Service Areas:
1. Layout and mock-up areas.
2. Machine and welding shop.
3. Tool and instrument rooms.
4. Hanger space.
5. Storage.
6. Building service areas.
7. Office.
8. Locker and wash room facilities.

There can be no assurance that the Cornell Aircraft Powerplants Laboratory will be a striking success. It is also evident that a supporting interest on the part of students, faculty, and industry alike cannot be marshalled until the laboratory is a functioning physical reality. However, there is the conviction that to do nothing is to be nothing; to venture nothing is to gain nothing. To accentuate the positive, one may indicate that a progressive, enterprising, and worthwhile program of instruction will surely develop competent staff, attract promising students, and promote the active interest and support of industry to the end that Cornell University will be of further service to society in furnishing a broad program of instruction in still another field of human endeavor.

Proposed Program

The whole program of instruction in aircraft powerplants at Cornell is in its early stages of development. The active participation of interested students in this development is most welcome. The purpose of the program is to appraise the value to man of aircraft propulsion machinery and their contribution to modern culture; to discuss in some detail the technical principles and significance of aircraft powerplants, and to study their application to aircraft propulsion; to analyze trends in design and application of aircraft powerplants in the light of their past history and present status; and to indicate a course for future development. The program of instruction is intended to augment the prescribed curriculum in Mechanical Engineering at Sibley; it is not intended to duplicate in any sense the instruction given in the prescribed curriculum at Sibley or in the Graduate School of Aeronautical Engineering at Cornell.

In order to acquaint the reader with the course content of the proposed program of instruction in aircraft powerplants, the following outlines have been included:



General Electric I-16 Jet Engine Arranged on Thrust Dynamometer for Laboratory Testing.

3660—AIRCRAFT POWER PLANTS
credit 3 hours

This will be essentially a descriptive course covering the operating principles and general characteristics of reciprocating and turbine type aircraft power plants.

The course will serve as an introduction to the further intensive study of aircraft power plants on an elective basis. Its intent will be to acquaint the student with the present status of the aircraft power plant field, and to develop his interest in aircraft propulsion.

The course will consist of independent, but carefully coordinated lectures. Outside reading of pertinent technical papers in the current literature, and the solution of interesting illustrative problems will also be important parts of the course.

The topics to be covered by the lecture series are as follows:

PART I

Lec. 1. Historical Aspects of the Aircraft Power Plant .
Lec. 2. New Trends in the Aircraft Power Plant Field.
Lec. 3. Piston Engines and their Significance.
Lec. 4. The Otto Cycle and its Aeronautical Aspects.
Lec. 5. The Diesel Cycle and the Two Stroke Cycle Principle.
Lec. 6. Aircraft Engine Components—Principal Moving Parts.
Lec. 7. Aircraft Engine Components—Secondary Moving Parts.
Lec. 8. Aircraft Engine Components—Fixed Parts.
Lec. 9. Special Engines—Rotary, Opposed Piston, and Cylindrical Cam types.
Lec. 10. Valves and Valve Systems.
Lec. 11. Valve Gear Arrangements and Valve Timing.
Lec. 12. Reduction Gear Systems.
Lec. 13. Oil Pumps and Lubrication Systems.
Lec. 14. Preliminary Examination I

PART II

Lec. 15. Combustion Problems.
Lec. 16. Ignition Principles and Ignition Timing.
Lec. 17. Ignition Systems.
Lec. 18. Spark Control Mechanisms.
Lec. 19. Carburetion Principles and Simple Aircraft Carburetors.
Lec. 20. Mixture Control and Detonation.
Lec. 21. The Injection Carburetor.
Lec. 22. Supercharging Principles.
Lec. 23. Solid Injection Principles.
Lec. 24. Special Fuel Injection Cycles.
Lec. 25. Water Injection.
Lec. 26. Engine Auxiliaries.
Lec. 27. Piston Engine Performance.
Lec. 28. Preliminary Examination II

PART III

Lec. 29. Gas Turbine Principles.
Lec. 30. Aircraft Superchargers.
Lec. 31. Jet Engine Principles.

(*Continued on page* 40)

A Profession
With Promise

Engineers and Patent Law

By CYRUS D. BACKUS, '96

THE inquisitive mind is prone to dwell somewhat on related historical events. Many people now living recall the period when the learned professions were limited to about three, viz. the ministry, the law, and medicine. Perhaps teaching could be added. One generally fitted himself for these, except probably medicine, by attending a liberal arts college. Sometimes the preparation was through tutelage under more experienced professionals, analogous to apprenticeship.

The advancement of science and art and development of technology have, however, effected great changes, so that now there exist a very large number of professions of which that of the engineer occupies an important place. Not only is the practice of engineering strictly a profession, but from it have radiated a number of ramifications, the basis of which is the fact that they require more or less of an engineering education; and the persons who engage in such occupations have reason to feel that their work is at least as close to the engineering profession as is any side-line or auxiliary vocation. It is the purpose of this paper to describe, more particularly to engineers, a profession, not new, but on the one hand and from the present viewpoint having certain characteristics as if it were one of the said sideline vocations. It is patent law practice.

Why do people enter the patent law profession? A partial answer is that is has notable attractions. Not only must he who follows the vocation have a fairly good knowledge of all the important fundamentals of science and engineering, but he must follow new developments, for *his* work is in *the very front ranks of all scientific and technological progress*. Often he makes noteworthy inventions himself, as he is privileged to do, and to secure patents on them. The legal side also has its interesting aspect, since the young man starting in patent law may look forward to a practice in the federal courts—a practice which not only involves the characteristic subject matter of patents, but extends over a considerable range of the general law, and is usually quite remunerative. A further respect in which this profession is interesting is that clients frequently take out foreign patents corresponding to their United States patents.

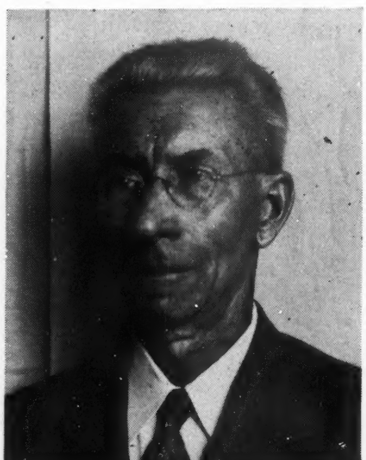
As a matter of fact, this profession has become so broadened and so intensified that the attorney becomes a specialist in a particular line, such as chemistry, electrical engineering, and the very active portion thereof known as communication engineering, including radio, telephony and telegraphy, and television, along with the all-pervading art of "electronics." A large professional firm may include a variety of such specialists.

Some kind of preparation or training is of course necessary before engaging in practice. Also certain official requirements and tests must be satisfied and met. Formerly, it was relatively easy to become

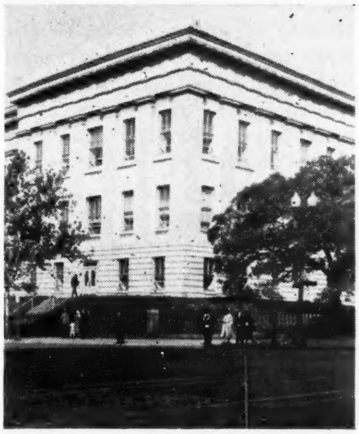
THE AUTHOR

Cyrus D. Backus graduated from Cornell in 1896 with the degrees of PhB and LLB. After practicing law in Syracuse and New York City, he was appointed to a position of the Examining Corps of the United States Patent Office. Mr. Backus entered the field of electricity and for 26 years was a principal examiner working mostly in electrical communications. While an assistant examiner, he received the M.S. degree at George Washington University.

Mr. Backus is a Fellow of the American Association for the Advancement of Science, a Member of the American Institute of Electrical Engineers, a Senior Member of the Institute of Radio Engineers, and a Member of the Cosmos Club of Washington. Since 1943, he has been engaged in the practice of patent law, first in New York City and now in Washington, D. C.



Cyrus D. Backus



Southeast corner of the "Old Patent Office" Building in Washington, D. C.

registered as a patent attorney. If one were already a member of the bar of a state and of a federal court, the registration was hardly more than a formality. Since, however, such legal attainment is not *per se* a complete qualification for patent practice at the present time, the United States Patent Office at stated times imposes tests by examination under the direction of the United States Civil Service Commission. This test is based mostly on questions relating to patent law and practice before the United States Patent Office. If the applicant for registration is successful on the examination and has the other general qualifications, then he is registered as a patent *attorney* if he is a member of the bar, or as a patent *agent* if not such a member.

Reverting to the preparation question, no particular training is actually required. The equivalent of a university education particularly in engineering is highly desirable. On the legal side, some schools, for example, in Washington, D. C. give special courses in patent law and practice, generally leading to a Master's degree. It has been recognized, however, for a long time that the patent practioner can acquire no better training than that derived from a few years service on the Examining Corps of the United States Patent Office, admission to which is obtainable by a difficult competitive examination in science and technics. The examiners often attend law school in non-service hours.

On the other hand, as previously intimated respecting professionals generally, many patent lawyers have worked upward through association with other patent attorneys. One special case of this is noteworthy. In view of the increase in recent years in the number of corporation patent departments and of the fact that in some cases the management of such departments did not consider it altogether ethical, or even to their own advantage, to deplete too much the experienced personnel of the Patent Office to build up their own personnel, the practice has arisen of transferring men from their engineering departments to their patent departments, especially if the individuals concerned indicate an aptitude and desire to make the change. A variation of this mode of transition often occurs when an engineer employed by a company or laboratory starts out on a more or less independent career such as consulting engineer. In this case, if during his previous employment he has made inventions on which applications for patents have been filed, he has had opportunity through conferences with the employer's attorney respecting those applications to follow the course of such applications and in this manner to become familiar with the prosecution practice.

Remuneration

This transfer from all-out engineering to patent work brings up the subject of remuneration and the related question how crowded the profession is. Is the patent law profession a lucrative one? The question can be answered only in a comparative way. In the first place, persons pursuing this vocation apparently earn at least a living, and a considerable portion, as is known from various sources, receive incomes that are probably equal to or above the average general law practitioner's income. As between the engineer and the patent attorney in the environment where the indicated transfers are made, it is generally understood that in the long run the attorney will receive the higher income. There are reasons for believing that the number of patent lawyers is not excessive. Not everyone who would aspire to be a general lawyer has an aptitude for technical and scientific expertness that is necessary in patent practice. Furthermore, the local distribution, as explained below, tends to put some restriction on entry into the patent profession. A revision of the patent lawyers' register recently made, indicates a total of approximately 5000 agents and attorneys registered to practice before the United States Patent Office. This, of course, is a small number relative to the total of general lawyers, and in periods of good times they are busy. Even in bad times, there appears to be a sort of momentum respecting certain fields of industrial development e.g. com-

The present United States Patent Office as it appears in the north end of the Department of Commerce Building. The large Search Room is under the colonnade end; the Washington Monument is seen at the upper left and the Potomac River at the upper right.

munication engineering, that keeps employment fairly steady.

The practice of patent law has a distinct locational aspect. With an exception to be noted, patent lawyers, unlike the general law practitioner, must in general establish themselves in localities where inventions are made and these latter in turn follow industry. Hence it is that the larger groups of patent attorneys are to be found in the large industrial centers. The Washington area in and around the District of Columbia is an exception. While there is some industry here and while also there is considerable inventing activity in governmental and private research, an important reason for the large number of patent lawyers in this locality is of course the convenience of being able to make direct contact with the Patent Office. This means that to a large extent the patent attorneys of this group act as local representatives of attorneys in distant localities. This representative capacity covers a wide field including prosecution of applications through the Patent Office and on appeal through the courts. Another side of this work comprises searches made in the voluminous records of the Patent Office to determine the novelty respecting new inventions before application for patent thereon is filed; and also investigations in such records in regard to the validity and ownership of patents already granted.

The reader may infer from the foregoing that patent lawyers are generally concerned with patents alone. This is not so. It would be fairly accurate to state that as a group they operate in a wider field, which, for want of a better description, can be termed that which relates to industrial property, much of which is intellectually produced, generally including not only inventions but other species such as copyrights and trademarks; also such lawyers operate in a large measure in court suits involving unfair competition in trade and business. These suits often grow out of alleged improper use of patents, copyrights and tradenames.

Elevated Status

The status of the patent lawyer from the viewpoint of professional ethics has been gradually elevated and it is fair to state that at present it ranks among the highest. In an earlier period it was rather difficult to deal with cases of questionable conduct on the part of the agent or attorney toward his inventor-client except where the patent attorney was a member of the bar and could be made amenable to disbarment proceedings, and except also in cases coming within the criminal law. A few cases now arise from time to time and are dealt with by a special committee in the United States Patent Office Administration. Adverse findings of this committee may lead to suspension or disbarment of the particular agent or attorney from practice before the Patent Office. From his long service on the Examining Corps of the Patent Office, this writer can assert without reservation, that it would be difficult to find an institution where the ethics of professional conduct on an average and in either direction were on as high a plane as in work carried on before the United States Patent Office. This condition may be due in part to the nature of subject matter dealt with, that is to say, science and technics where the scientific and research attitude plays an important role.

Opportunity for Engineers

The foregoing is not intended to depict this particular profession either in rosy or drab hues, but rather to give a concise review of several of its outstanding features, sufficiently perhaps to provide a basis for conclusion on the part of a young person, man or woman (for the profession is equally open to women and several have adopted it), respecting the selection of his future work. Observation indicates that many young engineers whether because of change of their own attitude or because of conditions not under their control, find it feasible to readapt themselves, which, of course, they generally must do in such a way as best to utilize their previous educational training, while at the same time they can perhaps realize at least an approximation to their original desires regarding a career. This has frequently been the case with patent attorneys. This does not mean that the patent law profession is a mere receptacle for misfits. On the contrary, this profession is on a solid basis, and if one selecting it has the qualifications and is willing to dedicate himself to the difficult and often very complex work involved in it, there is no reason for thinking he will not secure a fair measure of success.

Interior view of the large Search Room of the U. S. Patent Office, extending across the end of the Commerce Department Building. The patent stacks and library are to the right of the observer under an interior court.

Photo courtesy of P. J. Federico and A. W. Kaisen

Bottled Allure

By BILLIE P. CARTER, ChemE '49

Photographs courtesy Du Pont Company

"You know this must be the theme song of your life! You never felt the earth quake before. You never touched the stars before. You never heard this rhapsody racing up and down the keyboard of your heart. This is the moment you knew you'd know."

No, you're not observing an atomic explosion. The above is entitled "Prelude to Love," and footnotes a very romantic picture. And what do you suppose has caused this star-touching, earthquaking, rhapsodical scene? According to "those who know," the willing dispenser of Sin, Allure, Devastation, Surrender, and other rocky but desirable passions, it all depends on the type of scent milady daubs behind her ears. The whole situation seems so ethereal and entwined with the quaint magic of the days of the love potion, that not many stop to realize that a very large industry lies behind the little bottle of guaranteed mantrap. Perfumery is one of the oldest, most widespread and scientific of arts. Through the development of modern machinery and intensive research, perfumery today, as an industry in its own right, finds outlets in every field.

Perfumed World

We are indeed living in a perfumed world. All soap, even the cheapest laundry varieties, hair tonic, tooth paste, bath powder, baby oil, shaving cream, vanishing cream, air-conditioning, fabrics, synthetic rubber, medicines, stationery, gloves, tobacco, hosiery—to name just a few items—use perfume to improve their products. In the U.S. in 1944 perfumeries were supplying scents and flavors to over 150 different industries. Two per cent of a girl's lipstick consists of perfume, quite necessary to cover up the smell of the major ingredient—castor oil. Then there's the shaving cream manufacturer, undecided about perfuming his new product, who polled thousands of men on the subject. They all answered with a manly, emphatic "No!" Yet later he sent out two samples, one not perfumed and the other scented slightly. The unanimous choice of the men then was for the scented sample.

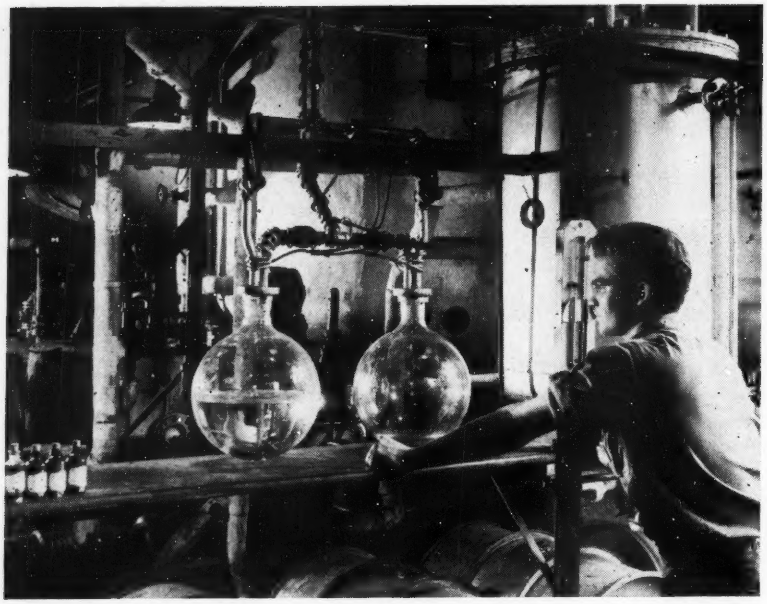
History

The use of perfumes is ancient. It is said to have had its beginning with the Atlantians who supposedly antedate the Christian Era by about 23,000 years. Earliest records of perfumery come from Egypt. The opening of the tombs of Tutankhamen, Queen Hetepheres (3500 B.C.) and other rulers of the early dynasties, revealed the wide use of scents and cosmetics. Egyptians used perfumes for three quite distinct purposes: as offerings to their gods, for personal beautification and pleasant living, and as principal materials for embalming the dead.

Later Babylon and Nineveh became the scent capitals of the modern world; an edict was even issued commanding everyone in Babylon to bathe his person in perfumes. It is said, though, that the ancient Greeks were the true perfume addicts. They had perfumes for each part of the body; scents to clear the mind, to cure every ill; and, of course, those guaranteed to win love. The beauty of Helen of Troy was rumored to have resulted from her use of a secret perfume revealed to her by Venus. In Rome, beauty shops and whole streets devoted to perfumers have been unearthed by excavators. Their favorite perfume was made by steeping rose petals in vats of wine.

Arabs Take Over

However it was the Arabs who experimented most with the technical side of perfumery. The Arabian doctor, Avicenna, for the first time successfully extracted perfume from flowers by distillation. Arabia led the way in knowledge and methods; from them, the Crusaders learned about perfumes and introduced new scents into Europe. Naturally the European ladies were fascinated, and the use of perfumes and cosmetics spread rapidly. Originally, all perfumes were powders, gums, or scented oils, or water or



A close check is kept for desired quality during preliminary steps in the distillation of a perfume chemical.

wine in which flowers had been steeped. The Arabian distillation process revolutionized the perfume industry and the products of attar of roses (essential oil isolate) and rose-water (diluted attar) monopolized the market as "perfumes of Araby."

The perfume hucksters made their appearance, touring Europe with their wares and claiming the most remarkable remedial and beautifying powers for their magic perfumes. Eventually the British Parliament, taking the matter very seriously, in 1774 passed their famous law of self-protection:

"All women, of whatever age, rank, profession or degree whatever, virgins, maids or widows, that shall from and after this act impose upon, seduce and betray into matrimony any of His Majesty's subjects by the use of *scents*, paints, cosmetics, washes, artificial teeth, false hair, Spanish wool (a kind of rouge), iron stays, hoops, high-heeled shoes or bolstered hips, shall incur the penalty of the law now in force against witchcraft and like misdemeanors, and that the marriage, upon conviction, shall stand null and void."

Synthetics

The research basis of the synthetic perfume industry was laid in the 19th century by Dumas, a French scientist. He examined the perfume essential oil of the flower and determined its composition as a mixture of organic substances, identifying several of the components. Between 1872 and 1890, French and German chemists determined the exact nature of the substances and were able to prepare many by direct synthesis from coal tar. Because the natural perfume constituents are extremely expensive, much research is still going on to find cheaper substitutes.

Essential Oils

Essential oils or aromatics are either natural, synthetic or artificial. Natural oils are the true oils actually distilled, expressed, or extracted from some root, bark, leaf, fruit or flower. Artificial scents are derived from plants, flowers, fruits, etc. or are imitations of some natural scent obtained by combining various scents or substances derived from plants. The synthetic scent however is not derived wholly from living plants, but from chemicals such as coal-tar, petroleum, minerals, etc.

Make-up

Every perfume consists of a large number of components. Even the "purest," most expensive attar of roses perfume contains many more substances than the true oil or attar distilled from the rose leaves. Three main classes of substances make up the perfume: the odoriferous (natural, synthetic. artificial oils); diluting agent and scent dispenser of alcohol; and fixatives which blend all constituents and give lasting quality.

Flower Cultivation

Europe has cornered the natural essential oil market. The smell of flowers varies with climatic and soil conditions and the most fragrant fields have been found in South France, Italy, Bulgaria, and also North Africa and British and Netherlands East Indies. Grasse, the perfume capital of South France, is ideally situated for almost year-round cultivation, with rotation of flower crops to suit the seasons. Most acreage there goes to jasmin, tuberose, jonquil, rose, carnation, and lavender. If jasmin sees the sun of its day of use, it will lose over 20 per cent of its perfume between the bush and the factory. In Grasse the jasmin open before dawn because of the night mist over the fields induced by the town's peculiar position. Thus the flowers can be picked before the sun appears.

Natural Oil Production

Production of the natural oils is classified as follows:

1. Distillation
2. Expression
3. Extraction by means of
   - (a) Enfleurage
   - (b) Maceration
   - (c) Volatile solvents.

There are two types of distillation: by boiling with water, and by means of steam (dry or live). The first method is the oldest and easiest; however there is always danger of destructive distillation taking place and producing impaired odors if some material comes in contact with the hot sides of the apparatus. In the second method the danger is overcome by producing the steam in a separate vessel. The distillate is condensed in specially designed receivers fitted with air or water cooling. The precious natural oil is not miscible with the water and can be removed by fractional tapping. Redistillation may be used, and the distillate can be separated into two or three frac-

tions. Many expensive flowers cannot be treated this way however, as heat and water change the character and destroy the odor value in these cases.

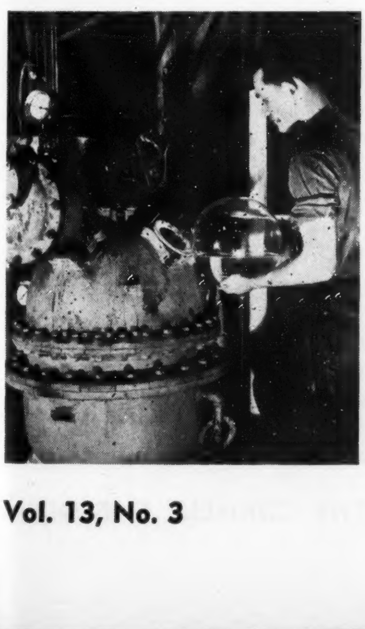
Expression is used for the separation of citrus oils from the peel of lemon, orange, bergamot, and lime. Pressing or spiking the tiny plant cells underneath the epidermis of these fruits eliminates the fragrant oils, which are later separated from the juices by clarification.

If quantity and quality of essential oils from distillation of certain plants and flowers is unsatisfactory, separation is accomplished by extractions by means of solvents. These solvents are classified roughly as volatile and non-volatile, and the latter are further subdivided according to conditions of temperature:

1. Extraction by means of non-volatile or fixed solvents such as animal fats or vegetable oils.
   (a) At normal temperatures—Enfleurage.
   (b) With the application of heat—Maceration.
2. Extraction with volatile solvents such as petroleum, ether, etc.

Enfleurage is the oldest perfumery process used in southern France. Once it was used for extracting all flowers; but modern methods have given more economical results, except with the jasmin and tuberose. These flowers are peculiar in that even after removal from the stem, they continue to produce

Treated castor oil being charged into a reaction vessel in the production of synthetic musk.



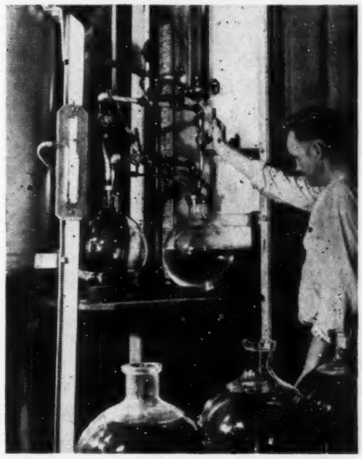
essential oils on standing. These odoriferous oils are given off and absorbed in fat.

The enfleurage process uses chasses or wooden frames supporting a glass plate of 30 inches. A thin layer of fat, pork or mutton is distributed on both sides of the glass with brushes. Petals are spread on the fat, and the chasses are stacked in tiers so that petals are enclosed between two layers of the grease. Fresh flowers replace the old ones, every day for jasmin and two to three days for tuberose. Flowers are removed rapidly by revolving brushes which do not touch the grease, and tiny particles remaining are finally cleaned out with special vacuum cleaners. Sometimes solid fats are replaced with liquid oil absorbers, in which case cloths saturated with the liquid replace the glass plates. Hydraulic pressure later removes this oil. When the fat or liquid oil is saturated with the perfume, this pomade is removed and extracted with several washings of pure alcohol. The perfume dissolves in the alcohol which is evaporated at low temperatures or under vacuum. The residue is concentrated perfume material called "concrete soluble." The residual fats are used in the soap and cosmetic industries, while the flowers removed from the enfleurage greases are further extracted by other methods for use in cheaper perfumes.

Maceration consists in the extraction of flowers by immersion in liquid fats or oils at a temperature of about 60 to 70 degrees C. Roses and most all flowers except jasmin and tuberose may be treated by this method. The heated grease and flowers is agitated in large containers for a certain time. The fat is then strained and more flowers are added. This process is repeated until the proper quantity of flowers has been treated, determined only after long years of experience. The exhausted flowers are subjected to heavy pressure to squeeze out all adhering grease. Essential oils are then separated from this perfumed fat or pomade in the same manner as with the enfleurage process.

Used Industrially

It wasn't until 1890 that extraction with volatile solvents was used



Lilac odor, unobtainable as a natural oil, is synthesized from the pure terpineol shown flowing into large glass bottles.

industrially. The most successful and generally used is petroleum ether of low specific gravity. Fresh cut flowers are placed into batteries of percolators. The solvent circulates freely and extracts the aromatics from the flowers. The resulting solution is evaporated either spontaneously or under vacuum, leaving the aromatics as a pasty residue. This contains waxes and other plant constituents subsequently removed by dissolving the residue in strong alcohol and cooling the solution to about 50 degrees C. The waxes separate out as solids and the liquid is filtered while still cold. After evaporating off the alcohol, the essential oil remaining is in its purest, most concentrated form as "absolute." This process is continuous and is more adaptable to modern plant operations.

Not much waste is encountered in the natural oil industry. After as much odor as possible in the form of the essential oils has been removed, the exhausted flower is used as fertilizer. Much of the scented waters, fat residues, and low fractions are used in cheaper perfumes, soaps, cosmetics, and allied industries.

Perfumes made from the natural essential oils are very expensive. A pound of "absolute" made from the volatile solvent extraction method costs from 250 to 1000 dollars. This can be understood readily when one realizes that a ton of roses makes 10 ounces of the oil;

(*Continued on page* 28)

"The name Grumman on a plane or part is like sterling on silver."

Vice-Admiral John McCain

PROFILES

—Leroy R. Grumman, '16

By CARL P. IRWIN, CE '49

These words by one of the Navy's top airmen sum up the attitude of that branch of the service toward the products turned out by Leroy R. Grumman M.E. '16 and his efficient team of airplane builders. Former Navy Secretary Forrestal said that Grumman planes saved Guadalcanal, and from the men that flew Grumman planes comes even higher praise. Nearly everyone is familiar with the remarkable records set by the Grumman F4F Wildcat, the F6F Hellcat, and the TBF Avenger; but no so well known is the fact that at the end of the war Grumman was making two new fighters that promised to be superior to anything he had yet turned out. They were the F7F Tigercat and the F8F Bearcat. Not only did Grumman make ships that blasted Japan's best out of the skies, but he did it when they were needed most and in record breaking time. In recognition of this President Truman, on March 14, 1946, presented to Grumman the Medal for Merit which is the civilian equivalent of the Distinguished Service Medal. The citation read:

> "Leroy R. Grumman, for exceptionally meritorious conduct in the performance of outstanding service to his country and its war effort, in the design and production of several of the most efficient types of aircraft supplied the Navy. As President of Grumman Aircraft Engineering Corporation, Mr. Grumman served as active head of an organization which, by outstanding initiative in searching out and making improvements, maintained its aircraft constantly at the forefront of operational and combat efficiency. Mr. Grumman, by furnishing potent weapons, has contributed greatly to the effectiveness of United States naval aviation and its achievements of air superiority in the theaters of war."

Roy Grumman does not fit the traditional idea of a big businessman. He did not even advertise until his schoolboy son complained that none of his friends had heard of the company. *Time* Magazine reports that a Navy pilot, on being introduced to Grumman, said, "You don't look like the guy who builds Wildcats." Medium sized, and somewhat stoop-shouldered, Grumman looks more like the man next door than the Navy's top plane builder. However his shirt-sleeve attitude toward his work, and his belief that a happy worker is an efficient worker, have had much to do with his success.

Along with any credit Grumman receives, though, must go regognition to the two men, who with Grumman founded the company in 1929. They are Leon A. "Jake" Swirbul, Vice-President and General Manager, who also received the Medal for Merit, and William T. "Bill" Schwendler, Vice-President and Chief Engineer.

Pilot in Navy

Grumman was born at Huntington, Long Island, 52 years ago, and has worked on or around Long Island for most of his life. His present home is at Plandome and the Grumman factory is at Bethpage. His father was a carriage manufacturer, but young Roy decided to become an engineer, and entered Cornell for training. He graduated in 1916 after working his way through. Shortly afterwards he enlisted in the Navy and was trained as a pilot. He was later sent to M.I.T. for further schooling and eventually became a test pilot, emerging from the Navy as a Lieutenant, j.g. His Navy experience was sufficient to qualify him for a job with Loening Aircraft as general manager. He held this position for nine years, but after the 1929 crash Leoning merged with another company and Grumman was faced with accepting a job of lesser responsibility or leaving the company altogether. He, Swirbul, and Schwendler, who were faced with the same alternative, chose to leave Loening and form a company of their own. Of the $32,000 they invested, Grumman put up approximately half and The Grumman Aircraft Engineering Corporation was born.

The first Grumman factory was a converted garage at Baldwin, L. I. and the chief work of the company was repairing wrecked airplanes. There were sixteen employees and their work must have been good for the new company soon acquired a nation-wide reputation. Luck was on their side, however, as is shown by their good fortune in purchasing a wrecked plane for $450 which was repaired and sold for $20,000—a neat profit in any business. In 1930 Grumman began work on an aluminum float which later became standard on all Navy scout planes. The Navy first ordered two of the floats, but later balked when its engineers expressed doubts about the safety of such a light support. To prove their faith in its design Grumman and Swirbul allowed themselves to be catapulted from a battleship on a plane equipped with the floats. They landed safely and Grumman got his contract. Constantly working to improve his product, Grumman redesigned the float and also invented a retractable landing gear for fighters. The first plane to have this gear was the XFF1 which was delivered in 1931. Its remarkable performance won an immediate contract and from then on Grumman was the Navy's plane builder. He moved to a larger plant at Farmingdale, L. I., and worked throughout the 1930's on Navy orders, de-

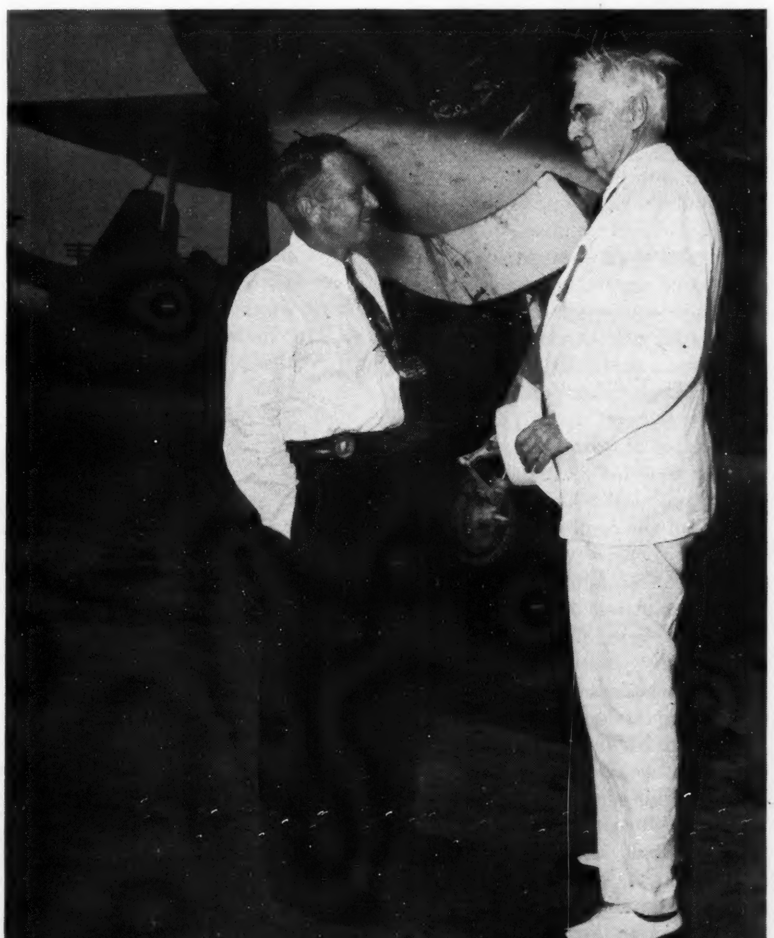
veloping the famed barrel-shaped fuselage which has become almost a Grumman trade-mark. In addition he manufactured aluminum truck beds and started production on two amphibian planes which found favor with such wealthy purchasers as Marshall Field, Henry S. Morgan, Robert R. McCormick, and Lord Beaverbrook. A lack of ready cash to complete existing orders almost forced him into bankruptcy in 1937, but he was saved by a Wall Street financier named Bernard Smith who was interested in purchasing an amphibian and largely underwrote a stock issue.

Before Pearl Harbor Grumman had been producing the F4F Wildcat and the TBF Avenger for the Navy. Immediately after we entered the war, while other plane makers were arguing over design or waiting for word from Washington, Grumman went to see William S. Knudsen who froze Grumman designs, thus enabling Grumman to greatly expand his operations. The new Grumman plant at Bethpage, L. I. was not large enough and sub-contracts were let all over Long Island. The result was a steady flow of Wildcats to our critical front in the Pacific. The Navy also used Wildcats in the Atlantic, however, and has revealed that in one six month period over half the German submarines sunk were accounted for by Wildcats flying off the decks of baby flat tops.

The folding wing, which increased the number of planes that could be carried on a carrier by half, is a Grumman invention, and *Time* reports that he got the idea for it by experimenting with a rubber eraser with paper clips stuck in the side for wings. He believes, "You can see things that way you can't see on a blueprint."

Bernard Baruch and Leroy Grumman conversing under the nose of a Grumman fighter during the war.

Courtesy Grumman Aircraft & Engrg. Corp.



Early in the war Wildcat pilots reported trouble with the Japanese Zero. Swirbul was immediately dispatched to the Pacific where he interviewed pilots and got their ideas on what kind of a fighter it would take to outfly the Zero. Back at Bethpage he, Grumman, and Schwendler sat down and worked out the design of the now famous F6F Hellcat. It was not just a bigger Wildcat, but was an entirely new ship, and the first to be designed from combat pilot's specifications. One captain called it "the answer to a fighter pilot's dream." The new ship was rushed into production and only five months after the first one was made, they were rolling off the production line. This kind of speed was unheard of in the aircraft industry, but is typical of Grumman's ability to get things done.

Grumman's office is always open to his employees and informality is the rule. An extremely simple incentive wage plan based on the output of the plant as a whole was another important factor in the Grumman production record, which was never marred by strikes or a high absentee rate. Now that the war is over the huge plant has been partially converted to the production of an aluminum canoe designed by Grumman. However, experiments on new types of military aircraft are constantly being carried on.

Scholarships Established

Grumman believes that education pays off. This is shown by his establishing a Grumman Scholarship at Cornell for Long Island students.

Mrs. Grumman is the former Rose Werther. She married Grumman in 1921. They have four children, Marion Elinor, Frances Werther, Grace Caroline, and David Leroy. Grumman is a Fellow of the Institute of Aeronautical Sciences and a member of the Society of Automotive Engineers. He still flies and says, "When you are alone 5,000 feet in the air lots of things about a plane become important that you can overlook on the ground."

The Editor's COLUMN

Metallurgy To The Fore

Great news echoes this term from the halls of Olin. The School of Chemical Engineering has ceased to exist. With the creation of the department of metallurgy, the title of the school has been changed to the School of Chemical and Metallurgical Engineering, still under the rein of Director Rhodes. More important than the change of title is the news that the school now offers a five-year curriculum leading to the new degree of Bachelor of Metallurgical Engineering.

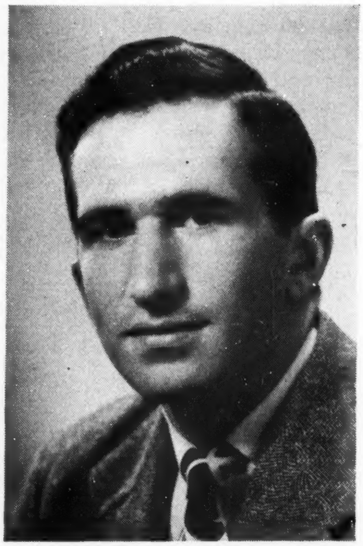
The equipment and instruction for the courses will be of the best. Foundry facilities on the campus are being expanded. Considerable equipment has been donated by industrial firms. The Foundry Educational Foundation has established ten valuable scholarships for undergraduates, and has assured summer and post-graduate employment for students enrolled in the new curriculum. Not the smallest contribution to the program is that of Peter E. Kyle, the able chairman of the department of metallurgy, and recently named Francis Norwood Bard Professor of Metallurgical Engineering.

Holidays And Cutting

Instructions have been issued to the faculty to use all possible means to discourage the cutting of classes before and after major holidays. Professors are urged to schedule examinations, whenever possible, on days immediately preceding and following a holiday. Absences will not be excused, and no make-up examinations granted.

The problem of holiday cuts is indeed worthy of attention, but deliberate rescheduling of examinations is hardly a good solution. The student considers the days on which to exercise his cut privilege a purely personal matter. Administrative action without regard to his side of the argument invites resentment which can be more detrimental to good scholarship than a day away from classes. *B.A.L.*

PROMINENT



Ben

Ben-Ami Lipetz, ME

When Ben laid down his kit of tools as trouble-shooter and Assistant Editor of the CORNELL ENGINEER in 1945 to join the Navy we sighed, but held on, knowing that he would be back one of these days. Well, Ben came back to us last year and is now managing his old magazine, operating on the same stand with new fixtures, for he now holds the title of managing editor.

Ben came to Cornell from the Bronx High School of Science, then a new school, where he got his first taste of academic science.

Ben took his journalism seriously as editor of the high school paper. He liked the combination of science and writing so well that he decided to combine them if at all possible. After high school Ben went to work for the American Standards Association, quitting soon afterwards to take the New York scholarships examination. The fact that his brother is a graduate of the Cornell School of Electrical Engineering did not influence Ben toward Cornell. The broad aspect of the Sibley school, the beauty of the campus, and the benefits of coeducational life were much more important to him.

At Cornell Ben has a long line of activities to his credit, including the Straight music committee and the Octagon Club, for which he wrote the lyrics to 'Maid to Order,' last year's Spring Weekend show. He is a member of Tau Beta Pi and is active in Pi Delta Epsilon, honorary journalism society. His hobbies are music, novel cookery, and stamp collecting, especially Philippine stamps. Ben is easy to get along with, 6'1", has chestnut eyes, and now lives in South Baker Dorm. He thinks highly of the Cornell coed!

Ben's ideal is to have the CORNELL ENGINEER as the voice of the student engineer, to fully provide common ground for engineers, and to serve Cornell and industry by writing the facts on the latest developments of the departments of engineering and science. His work as managing editor has helped to make the ENGINEER a better magazine, and we hope to continue his good work.

Robert Seidel, ME

On first meeting Bob Seidel, one is impressed by broad shoulders, ludicrously jammed into Navy undress blues, and a large head, which is later found to be crammed with inexhaustible information on hun-

Sei

ENGINEERS

dreds of diversified topics including science, art, religion, skiing, and women (one in particular). Graduated from Nottingham High in Syracuse, Sei dreamed of becoming a physics professor, beard and all. But the Navy had other plans in 1944, and he wound up at Cornell as a V-12 electrical engineering student.

Typical of his tenacity, Sei applied himself to his new vocation with an industriousness that ranked high in academic achievement. He became a member of Tau Beta Pi, and served as treasurer of Eta Kappa Nu during the past year.

Any keen mind which is diverse in aptitudes is hardly satisfied with an academic record alone. In 1945, a year before his discharge from the Navy, Sei pledged Phi Kappa Psi, and, in this, his last semester, is serving his second consecutive term as president. In Sei's mind, extracurricular activities are even more important than high grades.

Sei has done a good job at Cornell. Besides attaining a high scholastic standing, he has distinguished himself in varied and wide associations with other students, in administrative activities in many college organizations, in competitive sports, and in matters of study outside his chosen field. These are the contributing factors in achieving a broad and full college education. If his successes in the past few years are any indication of a successful future, may others of succeeding classes fare as well by his example.

Robert Heath, ME

For a fellow who entered college for the first time at the age of twenty-two, Bob Heath has set a remarkable pace as far as scholarship and outside activities are concerned. Bob was stationed on Maui, one of the smaller islands in the Hawaiian group, serving as an aviation machinist's mate in the Navy, when 1944 rolled around. Availing himself of the opportunity to join the ranks of the V-12, he suceeded in passing preliminary exams and came to Cornell in March.

Bob was in the midst of his fifth term when his eyes became troublesome and could not pass the rigid standards set by the Navy for its

Bob

V-12 students. It was a hard blow after waiting for so long to get the opportunity to come to college. But Bob had made his mark at Cornell and was determined to come back as soon as he was discharged from

(*Continued on page* 32)

Warren K. Brown, CE

Brownie

One of the busiest members of the senior class is Warren Brown, better known around the Cornell Engineer office as 'Brownie.' As business manager of the Engineer, 'Brownie' scurries about like the proverbial elf in search of advertising, subscriptions, and all else that will swell the coffers of the magazine. Warren also takes a great interest in the developments of his own branch of study, which is civil engineering, and is Secretary and Treasurer of Chi Epsilon, the Honorary C.E. fraternity, besides being a driving force in the local A.S.C.E. In connection with his journalism, he is a member of Pi Delta Epsilon, honorary Journalism society. With what little time these other activities leave him, he manages to serve on the Civil Engineering Honor Committee, and still do his lab reports.

'Brownie' was born in Deposit, N. Y. in 1926. As a child he got his first touch of civil engineering as he toyed with his Erector set and built dams and bridges all over the house. He went to high school at the Union Academy in Belleville, N. Y. Busily engaged in studies and athletics, he managed to graduate in 1944 and was faced with a problem of what to study. He had wished to be an engineer. Chemical engineering seemed nice at the time; but Warren had always preferred physics to chemistry, and, lacking prerequisites for Chem E, turned to Civil engineering and today says. "I think I made a wise choice."

The outdoor life has agreed with 'Brownie' in the past, as he has spent his summers surveying with the State Highway Department. He plans to enter the construction field upon graduation, and will endeavor to work in the wide open spaces.

'Brownie' is a man of the arts, catering to the three B's, baseball, basketball, and bridge.

News of the College

ChemE Changes Name

The School of Chemical Engineering has been renamed the School of Chemical and Metallurgical Engineering. Dr. Fred H. Rhodes will continue as director of the school.

Under the new set-up all metallurgical courses in the College of Engineering will be consolidated in the Department of Metallurgy under Professor Peter E. Kyle.

Bard Professorship

The first Francis Norwood Bard Professor of Metallurgical Engineering is Professor Peter Edward Kyle of the School of Chemical Engineering. At a dinner in Willard Straight Hall on November 7th President Day formally accepted the endowment which establishes the professorship. Mr. Bard is the owner of the Barco Manufacturing Company of Chicago and was present at the dinner along with Professor Kyle.

In establishing the professorship, Mr. Bard stated that in his opinion, it must follow two basic courses. The first is the inspiration and development of keen, productive, scientifically minded men in the field of metallurgy, and the second is the undertaking and accomplishment of metallurgical research of the highest order.

Professor Kyle

Professor Kyle received his M.E. from Cornell in 1933 and did graduate work at Lehigh and M.I.T. In 1946 he left M.I.T. where he was an associate professor to return to Cornell as Professor of Metallurgy in the School of Chemical Engineering.

B. Met. E. Degree

A new degree, Bachelor of Metallurgical Engineering is now being offered at Cornell under the five-year plan. The new course is given under the School of Chemical and Metallurgical Engineering and is co-ordinated with the curriculum in Chemical Engineering in that school. The curriculum in Metallurgical Engineering is designed primarily to prepare men for effective professional work in physical metallurgy, foundry practice, and related fields. The course of study is:

FIRST YEAR

	Term 1	*Term 2*
Introductory Inorganic Chemistry	6	2
Qualitative Analysis	—	5
Physics	3	3
Analytic Geom. and Calculus	3	3
English	3	3
Drawing and Descriptive Geometry	2	2
Casting, Working and Welding of Metals	2	—
	19	18

SECOND YEAR

Calculus and Differential Equations	3	3
Organic Chemistry	2	0
Fundamentals of Machine Tools	1	0
Science in Western Civilization	3	3
Quanitative Analysis	6	0
Physics	3	3
Mechanics	0	3
Minerals and Ores	0	2
Economics	0	3
Public Speaking	0	3
	18	20

THIRD YEAR

Physical Chemistry	6	6
Mechanics	3	3
Materials of Construction	3	3
Chemical Microscopy	3	0
Metallurgical Calculations	2	0
Psychology	3	0
Intro. Metallography	0	3
Engineering Materials Lab.	0	3
	20	18

FOURTH YEAR

Chem. Eng. Thermodynamics	3	2
Physical Metallurgy	6	0
Unit Processes of Metallurgy	3	2
Slag-Metal-Atmosphere reactions	3	0
Library Use and Patents	1	0
Metal Casting and Working	0	3
Corporate and Industrial Organization	0	3
Industrial Accounting	0	3
Industrial Statistics	0	3
Electives	3	3
Plant Inspection	0	1
	19	20

FIFTH YEAR

Ferrous Metallurgy	3	0
Non-Ferrous Metallurgy	0	3
Senior Project	3	3
Statistical Quality Control	3	0
Electrical Engineering	4	4
Electives	6	6
Metallurgical Design	0	3
	19	19

There are now twelve freshmen and fifteen sophomores registered for the degree in metallurgical engineering. It is anticipated that the enrollment will increase considerably by admission of new students at the freshman level, but increase in registration beyond the limit at which a high degree of effectiveness of instruction can be maintained and beyond the point justified by the demand for well-trained metallurgists for responsible positions in industry is not contemplated.

The Foundry Educational Foundation has established ten scholarships, each to the amount of six hundred dollars annually, available to undergraduate students in Metallurgical Engineering. It is understood that additional scholarships will be made available in subsequent years. Five of the current scholarships are awarded to men in the entering freshman class; the remaining five are awarded to second-year students who have entered the metallurgical curriculum by transfer from Mechanical Engineering or from Chemical Engineering.

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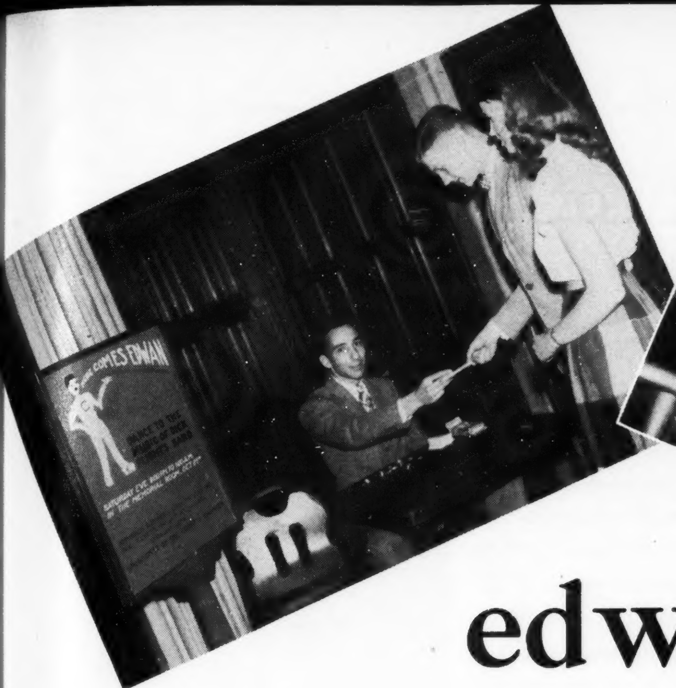

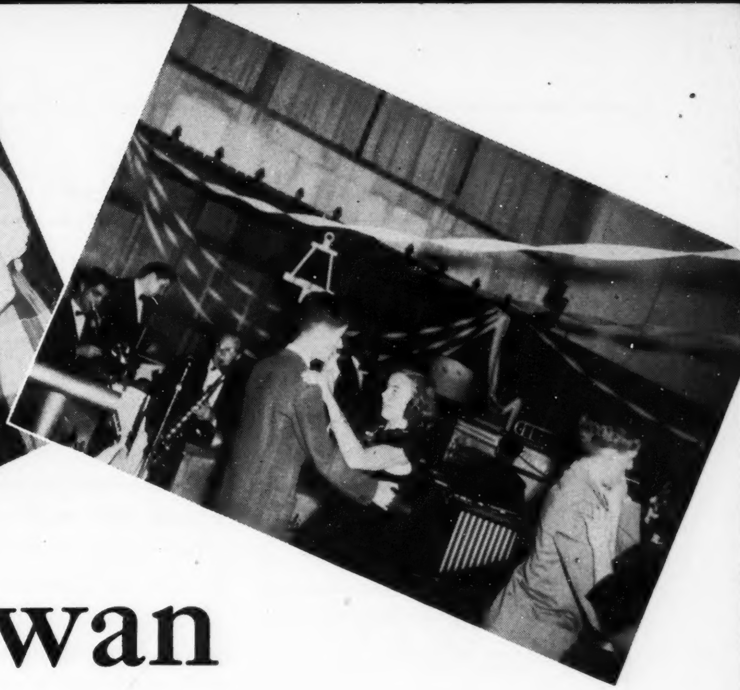

edwan

The first ENGINEER-sponsored campus-wide social event named simply "EDWAN," the "Engineers' Dance Without Any Name;" was inaugurated on October 25. Terpsichorean tastes of a hundred couples were admirably placated by Dick Flight and his orchestra from nine till one in the Willard Straight Memorial Room. Responding to multiple requests, the orchestra provided several impromptu polkas and waltzes for the more energetic dancers.

Dispensing tickets from behind a portion of the evening's bounty is Jack Zakin (upper left); one of Howie Kaltbaum's artistic posters announces the occasion. Chaperones Warren and Loe Higgins and Jean and Dick Hempel (lower left) enlivened the dance. Both Warren and Dick are on the ENGINEER staff.

The dance is expected to become an annual affair. It is hoped that it will eventually will develop into a full social weekend under the joint sponsorship of all engineering organizations. EDWAN, this year, was undertaken by the CORNELL ENGINEER alone. The entire staff assisted co-chairmen Leonilda Altman and Ken Gellhaus with arrangements.

Posters of the keys and insignia of the various campus engineering societies, as well as a huge cardboard slide-rule, were placed about the walls for "atmosphere." Upon conclusion of the dance, one couple was apprehended leaving with the Tau Beta Pi poster. (Background, upper right.) Caught dead to rights, the undaunted engineer pleaded that he might retain the poster to hang in his room because "it's the closest I'll ever get to Tau Bete!"

Cornell Society of Engineers

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KARL J. NELSON, *Vice-President* ....321 North Avenue East, Cranford, N. J.

GEORGE C. BRAINARD, *Vice-President* ....1200 Babbitt Rd., Cleveland, Ohio

LINTON HART, *Vice-President* ....418 New Center Bldg., Detroit 2, Mich.

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

Carl F. Ostergren

President's Message

One of the basic questions often raised about engineers individually and generally is whether they stick too close to their professional knitting and, as a result, make less of a contribution as citizens than their training and occupation qualify them to make.

It is a good question, an important one, and deserves being thought about a good deal by engineers, educators, and students.

The question is not raised with respect to local citizenship, except possibly in some of the largest cities. It is raised chiefly about national and international affairs, which are merging with increasing rapidity as technology advances and nations, as well as individuals, become more and more interdependent.

The events of 1947 point up the problem sharply. Wise policies, moderation, firmness, and back of them an interested and informed people —surely these are required.

It is natural that the publicists and those whose background is the law should be heard from most in these matters. But the publicist, when he is not simply reporting, is likely to seek sensation, while many lawyers tend to put advocacy first.

The contribution which the engineer and the scientist can make should need no elaboration here. It lies not only in the knowledge and control of the techniques; it lies also in the basic training which requires that progress be made toward solutions, but that it be made with a maximum of fact and reasoning and a minimum of sound and fury.

The five-year course in engineering at Cornell, now fully in effect, shows clearly the University's view as to the need of broadening engineers' background and interests. I am sure the vast majority of the engineering alumni are heartily in favor of that change.

The engineering societies, including the branches of the Cornell Society of Engineers, might give this whole question more attention in their activities.

And it would be a fine and healthful thing if we were to see more and more engineers of recognized capability taking part in the debates and the decisions which will mean so much to all of us.

CARL F. OSTERGREN

Alumni News

Guy H. Thayer ME '90, has retired as naval architect with the Port of Portland, Oregon, a position which he held for twenty-one years.

Charles M. Chuckrow CE '11, formerly executive vice- president of Fred T. Ley and Co., Inc., general contractors, has returned to that organization as its president. He was recently associated with the Tishman Realty and Construction Co., also of New York. Chuckrow, who joined the Ley Company shortly after graduation from Cornell, resigned in 1933 to become president of the Fred F. French Co. With French, he organized the Fillmore Construction Co., Ltd., of London, England. A past president of the Cornell Society of Engineers, Chuckrow was formerly a member of the Engineering College Council. He also served on the committee of the Commerce and Industry Association which drafted the Urban Re-development Corporation Law.

Charles P. Palem CE '13 is superintendent of the machinery installation division of the Newport News (Va.) Shipbuilding and Dry Dock Company.

Carlton Ward, Jr., ME '14, president of the Fairchild Engine and Airplane Corporation, 30 Rockefeller Plaza, New York City, addressed the sub-committee on aviation of the Senate Committee on Interstate and Foreign Commerce. As chairman of the industrial preparedness and planning committee of the Aircraft Industries Association, he spoke on industrial planning.

Lacy L. Shirey CE '20 is assistant bridge engineer for the Chesapeake and Ohio Railway Co., Richmond, Va.

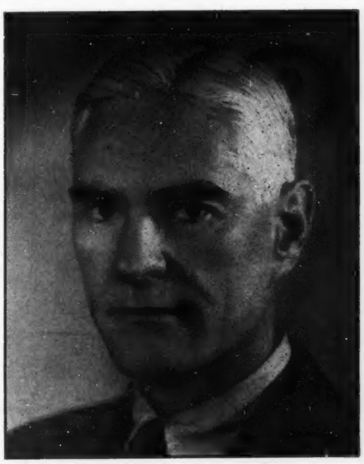
Paul H. Knowlton Jr., ME '24, has been appointed assistant division engineer in the turbine-generator engineering division of the General Electric Company, of Schenectady, with general responsibility for thermodynamic and fluid flow design and research. He has been with the company since March 1925, when he became a student engineer on a turbine development test. In 1926, he was assigned to the steam research section of the turbine engineering division, and in July 1944, was made assistant designing engineer on thermodynamics.

Clarence A. Dayton CE '27 has joined F. H. McGraw and Co., engineers and contractors, operating in the United States and foreign countries, as chief estimator.

Robert A. Sharood CE '27, is now chief engineer for the Alaska Railroad in Anchorage, Alaska.

Ernest H. Kingsbury ME '29 has been named technical advisor to Flight Safety, Inc., of Philadelphia, Pa. He was previously associated with the Glenn L. Martin Co., Baltimore, Md., and All American Aviation, Inc., Wilmington, Del.

Lieutenant Colonel John D. Payne CE '30, of the Corps of Engineers, AUS, is on duty with Headquarters Air Defense Command at Mitchell Field as executive officer of the engineering division.



Carlton Ward, Jr.

Walter H. Morris ME '35 is project engineer with the H. K. Ferguson Co., construction engineers.

Howard T. Critchlow Jr., '36, recently joined the Carver Pump Co., Muscatine, Iowa as chief industrial engineer. The firm manufactures self-priming and straight centrifugal pumps.

> The University Placement Service has issued a list of thirty-eight "registrants available," half of whom are seeking engineering positions. The age, marital staus, previous experience, Cornell degrees and salary and location desired are given for each registrant. "Job bulletin" lists containing positions open to alumni who are registered with the Placement Service may also be obtained from the Placement Service, Administration Building, Ithaca or at 107 E. 48th Street, New York City.

Bartholomew J. Conta, MS '37, associate professor of Heat-Power Engineering at Cornell, has resigned to become professor of Mechanical Engineering in the College of Applied Science at Syracuse University. Professor Conta was an instructor in the electrical engineering school at Cornell from 1937 to 1940. The following year he worked as a research engineer at the Beacon laboratories of the Texaco Company and returned in 1941 as an instructor in the Heat Power Engineering Department.

Charles E. Sturtevant BEE '41, a design engineer in the transmitter division, electronics department, General Electric Co., will soon begin working at General Electric's new $25,000,000 plant known as Electronics Park, near Syracuse.

John E. Slater Jr. BS in AE(ME) '43 has resigned from the Ohio Public Service Co., and joined the McGraw-Hill Publishing Co., New York City, as a member of the business staff of Power and Operating Engineer magazines.

(Continued on page 38)

The Perennial Athlete

By L. L. OTTO

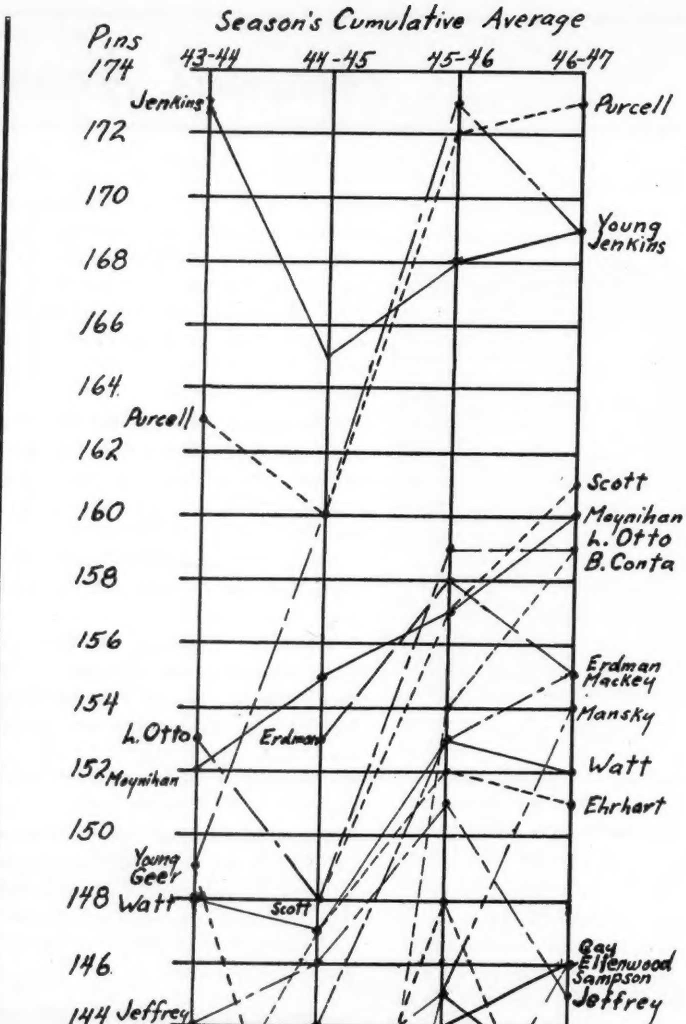
Historian, Sibley League

If a hard rubber sphere weighing 16 pounds moves in a vertical plane, how great a force must be applied to force it to move in a circular path of 30 inches radius at a peripheral velocity of 16 feet per second? If this sphere is directed along a level polished hardwood surface (friction coefficient about 0.01) at a tangent to its arc of swing, how far will it travel before its motion changes from sliding to pure rolling? If at the time of delivery the sphere is given a rotation of 2π radians per second about an axis parallel to the surface of travel, how great will its path of travel deviate from a straight line in a distance of 60 feet?

These might be problems in simple (?) mechanics posed by the faculty for a few minutes of mental exercise by engineering sophomores, but at Cornell the faculty is busily engaged in trying for themselves to find an answer to the problems which can be made to repeat time after time. Once every week ninety members of the faculty and service and administrative employees of the Electrical, Mechanical, and Civil Engineering Schools rush downtown to the Ithaca Bowl-O-Drome and spend an enjoyable hour and a half tossing a hard rubber ball down the polished hardwood alleys at a group of defiant ten pins. Each man tries between fifty and sixty times to find the proper combination of foot work, body movement, arm swing, and ball spin which will produce the much-desired strike.

Back in the winter of 1943-44

(*Continued on page* 34)



Techni-Briefs

Explosive Rivets

Explosive rivets produced at present by Du Pont are now being used by many manufacturers to improve their products and to cut down on costs. These rivets, prepared with a tiny charge of explosive built into a cavity along the length of the shank, will detonate on application of a heated tool similar to a soldering iron. The charge, on being fired, will expand the shank to form a barrel-shaped head which becomes a strong, permanent fastener. The cost of production of these rivets is naturally greater than that of ordinary solid rivets but that slight increase in price is more than made up for by the savings in time and labor and the increased strength of the final product.

Crystal Production

Silver nitrate crystals—the fundamental chemical of modern photographic processes—may be produced in the future by a process which will cut the production time from several days to but a few minutes. The Eastman Kodak Company of Rochester has recently put into use in their plant machinery which renders completely obsolete the old method of crystallizing the silver nitrate in a supersaturated solution and then drying these crystals in trays in a warm room. The new process involves dissolving ingots of pure silver in nitric acid and then pumping the solution into crystallizers where constant stirring of the highly saturated solution causes crystallization to occur. These wet crystals are then centrifuged in baskets to drive off most of the moisture before they are redissolved in distilled water. The process is then repeated except that this time the crystals, after being centrifuged, are dried completely in rotary drying drums. At this point the pure crystals are ready to be put to use in making the materials necessary to modern photography.

Electronic Diffraction

A new research tool which will be useful in the studying of metallic surface conditions and surface films of lubricants among other things has been developed recently by the General Electric General Engineering and Consulting Laboratory.

This tool is an electron diffraction instrument which, by the diffraction of electrons fired by an electron gun at the surface shows the diffraction pattern on a photographic plate. The electrons are fired in a high-vacuum compartment and are accelerated by a field of 40,000 volts. An exposure of five seconds is taken in this manner to show up the pattern.

Fields which will benefit from this invention are the study of the causes and cures of rust and corrosion, the characteristics of a good lubricant, the study of the actions of catalysts in a chemical reaction, and general metallurgical discussions of the surfaces of materials.

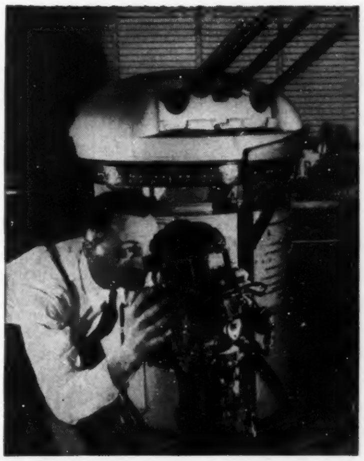
Fluxmeter In War

The magnetic field of the earth contributed on a large scale to winning the last war or at least keeping the major ports of the United States protected from enemy vessels. Any slight change in the magnetic field of the earth due to the presence of iron or some such magnetic material passing over cables laid across the entrance to the harbor was recorded by a device known as a fluxmeter. When any craft not authorized by the Navy passed over these cables, whether with motor silenced or in the dark, it was spotted immediately by this method and steps were taken to eliminate it as a source of danger.

Servo Mechanisms

"Servo mechanism" is a name for a principle by which a machine or other such unit may be controlled with a minimum of effort on the part of the operator. The servo mechanism will determine the direction and magnitude of whatever action is to take place under the impulse of the operator who operates a hand-dial to generate the electric signal. This obviously relieves the operator of the burden of doing the mechanical work involved giving him the opportunity to operate to his mental instead of his physical capacity.

During the war, the servo mechanism was used to control the fire of such things as the big guns on battlewagons and the fire of the gun turrets of long-range bombers. With this application obviated for the moment, its attention is being turned to such peacetime endeavors as the automatic control of valve operators, the control of testing machines, the operation of conveyor switches, etc.



The Servo mechanism applied to sighting guns on the B-29 by remote control.
Courtesy General Electric Co.

Out of Phase

By HERBERT F. SPIRER, E P'51

Open Letter to the Widow:

Dear Toothless,

I have a pet white mouse. A typical rodent, his forelegs are dwarfed and weak. With them he can manage to support a crumb of food or carry a delicate splinter for his nest. However, old bag, I have no doubt, that with his right foreleg tied behind his back, since he seems to show a preference for using that one, and using only his atrophied left claw, he could produce more palatable humour, prose, and editorials than those hackneyed Arkansas journalists cluttering up your lower-case masthead.

The ENGINEER has never before openly objected to the anemic nature of the archaic tripe you have been peddling. Although we prefer quality, we also have tolerance, the ability to look with a kindly smile on a poor little ugly duckling trying to eke out a meager existence.

And so, after years of washing windows with old Widows and keeping our Widow-inspired nausea to ourselves, we are slapped in the face by this parasitic editorial leper. First you called attention in an unbecoming manner to one of our favorite landmarks, the slightly crippled clock over Lincoln's Southwest entrance. Then, six months later, in your October slopsheet you have the audacity and crudity to "demand that the spurious timepiece . . . be repaired or replaced."

Why, I remember the peace of mind that clock gave me in my freshman year. One wintry day I rushed madly up the hill under the impression that it was after nine, and that my surveying class had already begun. And then, there was the pleasant face of the old southwest clock, beaming down on my perspiring brow. "Don't rush, Spike," it said, "Take it easy, relax, light up a Robert Burns . . . It's only quarter of. That's it, take off your shoes and romp in the snow awhile." What a friend the old clock was on that day. How well I recall the feeling of relief as the hours stood still. Yes sir, and when the mobs began rushing about the quad on their way to their ten o'clocks, there stood benevolent old Southwest, saying, "Take it easy . . . It's only quarter of, quarter of . . ."

No! You shall not, old broomrider, lay a palsied hand on our beloved clock. This letter is formal notice of the intention of the staff of the ENGINEER, Vladmir Sitzfleisch, and every able-bodied engineer to resist your decrpit legions. We shall march together in a crusade to save the Lincoln School of Civil Engineering from defamation by the foul breaths of degenerate pulp-hashers. We shall defend our clock to the end of time.

Edmund V. Sitzfleisch

Old Hour-Glass

Aye, tear her battered mainspring out
Long has it waved on high,
And many an eye has longed to see
That hour-hand come near to three.
Beneath her rang the rodman's shout,
And the answer, "My transit's out!"
The hero of the quad
Shall tell the hours no more.
Her face will be red with triumph
As slowly kneels the vanquished foe,
The shameful, and the blameful
Old Widow.

. . . James Russell Sitzfleisch

Save our clock . . .

The Cross-hair, official organ of the Rod and Snowshoe, has called an emergency meeting of all members of the society to band together for the purpose of saving the clock over the southwest entrance to Lincoln, so recently maligned by the campus' favorite stumble-bum, the Widow. Professor Winter will lead a group of Civil Engineers mounted on horseback and carrying sabers, to be known as the Cornell Cossacks. It is rumored that they are training for the battle, by spearing copies of Woods and Bailey and *Problems in Prose* being hurled at them from 100 mm howitzers. Prof. Perry will lead the fusiliers, whose colorful costumes have made them the delight of the engineering campus. They wear blue conductor's uniforms, with peaked caps, and carry as weapons, chrome plated ticket holders and simonized ticket punches. There are still a few openings for engineers ready to defend our campus from the onslaught from 111 Tioga.

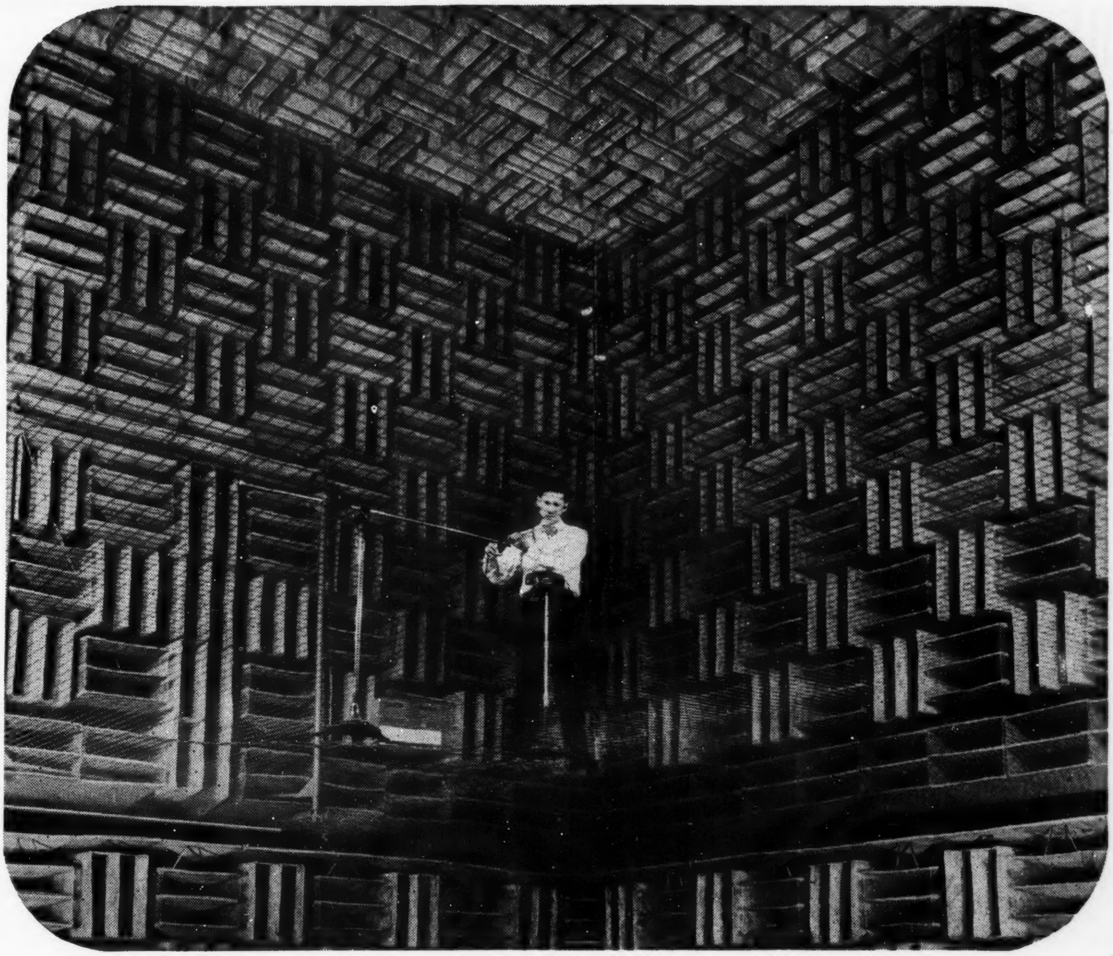
Phase Shifts

As Professor Cuykendall says in Strength, "Every couple has its moment . . . " Have you heard the Mexican Engineer's love song, *Bessemer Mucho?*

We overheard this choice bit in the freshman mechanics course. "Why," asked the instructor, "is a long pump handle advantageous?" And quick as a whip, Al Pellegrini replies, "Because then you can get someone to help you."

An arts school professor, coming to an Eco class late (name deleted by request) found a most uncomplimentary caricature of himself drawn on the board. Turning to the sleepy engineer nearest him, one William Denison, he angrily inquired, "Do you know who is responsible for that atrocity?"

"No sir, but I strongly suspect his parents."



Bottled Allure

(*Continued from page* 15)

33,000 pounds of violet leaves make a pound of essential violet oil, at 2000 flowers per pound.

Artificial Oils

Artificial oils are isolated from natural oils. They are semi-synthetic in that they synthesize a flower odor and yet are derived from natural oils of more common plants. An example of this artificial scent is geraniol, a colorless liquid having a rose odor. In nature, geraniol occurs as a constituent of the essential oils of many flowers, including roses, geraniums, citronella. Commercially geraniol is obtained by distillation from the oil of the citronella. The pure geraniol is the basis of many floral scents. It is not a truly synthetic odor since natural roses owe much of their odor to the geraniol. A large number of similar artificial scents from plant and floral oils are used to imitate various other natural scents. The advantage can be seen when we price citronella oil at 40¢ per pound.

But more important than the isolates are the synthetic oils. Mainly the synthetics are coal-tar derivatives. Thousands of varieties of odors are possible with the many odoriferous derivatives of coal-tar. Amyl compounds for instance yield many important floral and plant odors such as gardenia, jasmin, violet, lilac, cinnamon, rose, musk, tuberose, orchid, apple blossoms.

Fixation is of utmost importance in perfumery, for the demand is always for a scent that will last and not change character on evaporation. Animal fixators have been used for centuries, and it is said that artificial substitutes will never equal the natural musk, civet and ambergris. These are indispensable to the finest and most expensive of perfumes, for they give exciting odor notes and incomparable tenacity to the perfume blends.

Musk comes from the preputial follicles of the male musk deer inhabiting north India, China and Siberia. Civet comes from the Abyssinian cat of the same name. When the cat is angered, its abdominal pouches fill with a dark-brown, soft, smelly paste. In concentrated form this paste is evil-smelling, but if diluted a distinct, stimulating note is evident.

(*Continued on page* 30)

Bottled Allure

(*Continued from page* 28)

The last of these best and rarest of fixatives is ambergris, which is supposedly the pathological excretion from the intestine of a certain species of whale. It is slightly greasy to touch, usually grayish-black in color, often porous, and with practically no scent whatsoever. This latter property makes ambergris the perfect fixative since it is the only known substance which can definitely fix a scent without altering its odor. Musk and other fixatives have odors of their own which interfere with the scents of the essential oils. Some ambergris has been found in the intestines of whales, but more often it is discovered cast up on beaches or floating on ocean surfaces. It is one of the most valuable of all substances even today, and many have made their fortunes from its discovery. In the pure state ambergris is worth $40,000 per pound.

Recently a new source of natural musk has been found in the Louisiana bayous. The tiny glands of the muskrats trapped there yield musk alcohols which can be converted to odorous, fixative musk ketones by oxidation. DuPont now makes an artificial fixative called musk ambrette, by heating coal tar to 392 degrees F., and further converting the cresol obtained in this heat fraction. Musk substitutes are similar to, but c a n n o t equal the strength, power and depth of the natural musk.

Blending

Blending the perfume is as important as the quality of the oils comprising it. There are secret formulas galore for the making of the choice perfumes. 84 to 88 per cent of the perfume is the alcohol and the 12 to 16 per cent remaining is for the fixatives, essences and synthetics which may run from 30 to 2000 different elements. Odors are described basically as sweet, acid, burnt, or capryllic (goat-like), and combinations of these four fundamental types yield the best-liked perfumes.

Some of the most enjoyable perfumes are concocted with evil-smelling substances which, when mixed, give the pleasant bouquet. Here is a rough description of the blending of violet perfume oil: First ionone is used. It gives the main violet odor, and is made from the oil of lemon grass and acetone. Next the main odor is supported by similar odor notes such as orris oil or heliotropin and vanillin. To round out the chemical effect, oil of ylang-ylang, and oil of sandalwood are used. The "leafy" note is imparted by the addition of methyl heptine carbonate, unless the perfume is truly costly in which case actual violet-leaf concrete soluble is added. Small amounts of absolutes improve the odor but are expensive. Finally the fixative used must be the right combination of substances to blend all the components, and give full, fragrant and lasting violet aroma.

Odor Combinations

Odor combinations possible are typed as (1) *single flower*, one flower odor dominant (2) *single flower bouquet*, bouquet of flowers with one flower odor predominating

(*Continued on page* 32)

Exploration of ocean depths is made possible by RCA Image Orthicon television camera.

Bottled Allure

(*Continued from page* 30)

(3) *bouquet odor,* whole bouquet and no predominance and (4) *fantasy.* The single flower odor is the most difficult to obtain. Fantasy odor gives widest creative range to the perfumer.

The final test of every perfume is the highly trained expert with an exceptionally keen nose. There is no substitute for the human nose as a judge of the perfumers' art. In France the "noses" are men of great importance, with highest college and postgraduate degrees in chemistry. They are attributed with "seeing" noses and can distinguish and name accurately 7000 separate odors. Only the experts can differ between the mainly synthetic and natural perfumes. So clever are modern perfumers with their combinations that the layman is unable to distinguish the duplication.

Robert Heath

(*Concluded from page* 19)

the Navy. Bob reappeared on campus during the spring of '46 and has been here ever since.

Bob was elected to Tau Beta Pi, honorary society for engineers, his junior year. Much of his time this year has been spent in the catalogue office where he has been gathering statistics of all Tau Beta Pi graduates from Cornell since the society was organized on the campus some forty years ago. That adds up to a lot of hard work. The American Society of Mechanical Engineers (student branch) is another time-taking but very beneficial organization in which Bob has taken great interest. He is president of the student branch at Cornell which meets on the average of every two weeks.

College News

(*Continued from page* 20)

The present foundry at Cornell is now being expanded through the removal of welding and metal working equipment to other areas, thereby adding 3000 square feet for

(*Concluded on page* 34)

College News

(*Concluded from page* 32)

foundry instruction. The approximate value of this addition is $15,000, to which must be added the remodelling cost, bring the total to a minimum of $20,000.

The facilities being added not only will assist in the training of engineers in the foundry industry, but will add to the quality of instruction in foundry principles given to other students. It is hoped by the Foundation that students from all departments of engineering will elect to follow this program. There is room for all types of engineers, and the metallurgical department wants the rounded individual who can apply varied knowledge and thus cooperate closely with other divisions of industry.

Besides the provision of scholarships in the financing program which the Foundry Educational Foundation is carrying out, there is help given in placement for summer work. Upon graduation the foundation will see that there is a good job available. It is not the policy of the Foundation to force the graduates to accept certain positions. The idea is to show the engineer the light, so to speak—what advantages such positions offer. There is good reason in starting in at the bottom and then working up. The progress will be fast and the person will acquire a fuller training by understanding everything from the bottom up. The future for young men to fill places of responsibility in this $4,000,000,000 industry is most bright.

Readers who are interested in further information on the metallurgical program or about the procurement of scholarships should contact Professor Peter Kyle who is Cornell's representative for the Foundry Educational Foundation.

Perennial Athlete

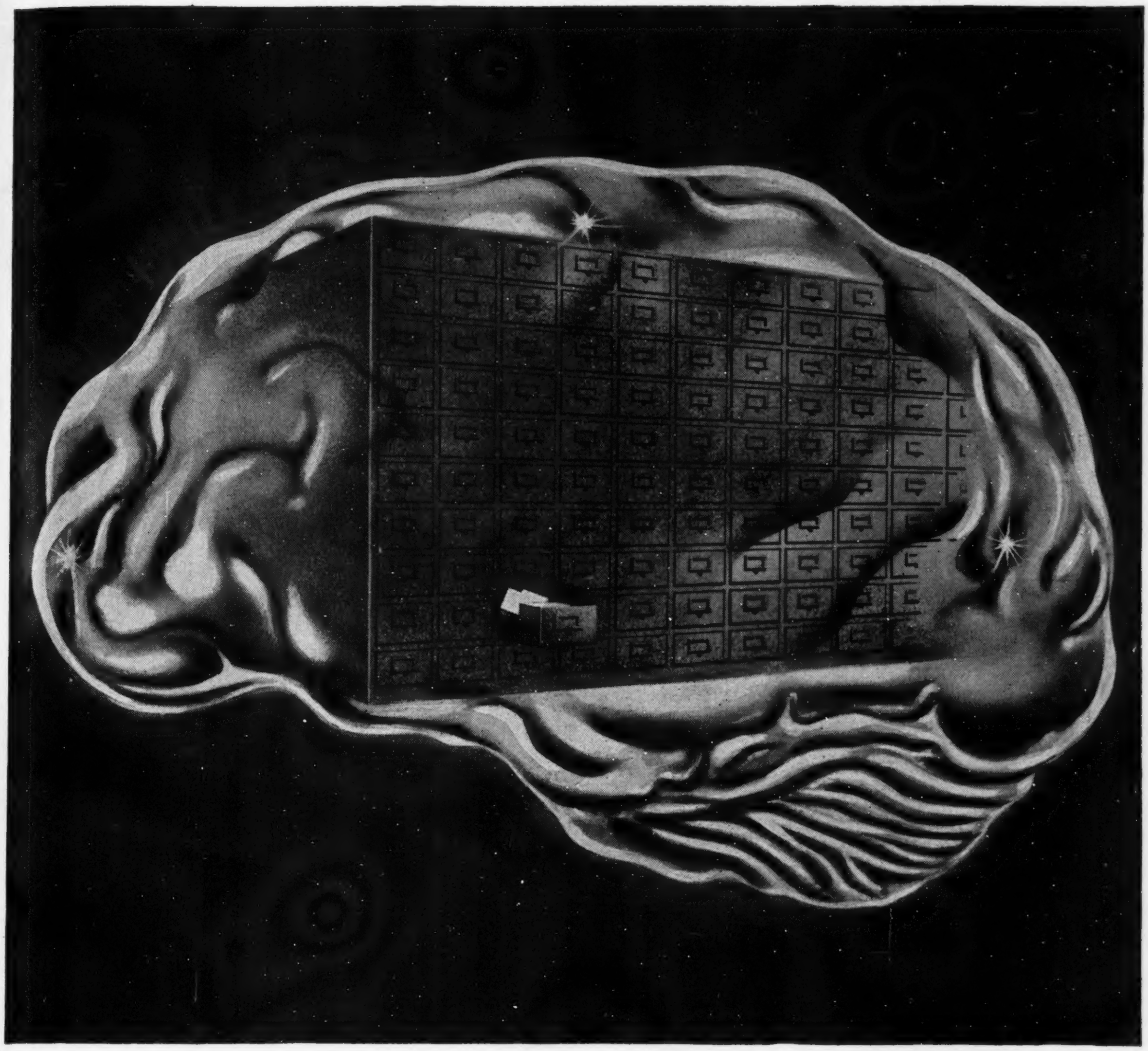
(*Continued from page* 24)

eighteen members of the faculty of the Sibley School of Mechanical Engineering gathered around a nucleus of its members who were bowling in the long-established University Bowling League and formed the Sibley Bowling League for the purpose of "conducting ten pin activities according to schedule in weekly contests between teams composed of male members of the faculty, administrative staff, and technicians of the Sibley School of Mechanical Engineering." League membership was limited to males because at least one of the secretaries in the School could regularly trim the men at bowling, and the charter members wished to maintain their feeling of male superiority on the alleys, if nowhere else. With J. R. Moynihan as President and J. R. Young as Secretary the league of six three-man teams completed a short but successful season with the "Welders," composed of A. P. Boehmer, G. A. Hill, and M. W. Lee, coming out on top of the heap.

League Expands

The success of the first attempt so enthused the charter members that in the fall of '44 the League

(*Continued on page* 36)



Perennial Athlete

(*Continued from page* 34)

was expanded to ten three-man teams under W. J. Purcell as President and L. L. Otto as Secretary. Competition began immediately in the fall of 1944 and continued through three full rounds with the "Heaters," comprised of J. R. Moynihan, G. H. Lee and D. E. Bacon winning the greatest number of points. In the 1945-46 season, ten teams under J. O. Jeffrey as President and L. L. Otto as Secretary again completed three full rounds with G. W. Ehrhart, C. O. Mackey and D. Williams, bowling as the MMS team, winning top honors.

Difficulties encountered during the '45-'46 season caused the League to move to the Ithaca Bowl-O-Drome for its '46-'47 season. With only eight alleys available some change in the previous ten team arrangement was necessary. An increase in the number of men wishing to bowl ruled out any contraction in League size. To accommodate these new men an additional league was formed. The Sibley League continued as an eight team league under F. O. Ellenwood as President and E. R. Watt as Secretary, bowling on Fridays from 5 to 6:30. The newly organized Thurston League of eight teams under F. O. Ellenwood as President and I. Katz as Secretary bowled on Wednesdays at the same hour.

Idea Spreads

The obvious interest and enthusiasm in bowling created by the Sibley League in Mechanical Engineering were not unnoticed in the other Engineering Schools. In the fall of '46 several men from Electrical Engineering wished to join the Sibley or Thurston Leagues, but lack of openings made it impossible to accommodate them. Not to be outdone by Mechanical Engineering, they organized the Franklin League, and every Tuesday afternoon under the leadership of J. Baird as President and W. H. Erickson as Secretary, six teams from Electrical Engineering vied for strikes and spares.

The '46-'47 season was as successful as previous seasons had been with J. R. Purcell, E. R. Watt, and D. Dropkin as the Turtles winning first place in the Sibley League; B. J. Conta, W. K. Clarke, and A. L. Lang as the Leftys winning the Thurston League; and H. B. Hansteen, S. Linke, and E. M. Strong as the Ohms winning the Franklin League.

So far the '47-'48 season has been a repetition and extension of the '46-'47 season. Several members of Civil Engineering wished to join one of the established leagues but found no openings available. Not to be denied, they organized the Lincoln League with M. Bogema as President and H. T. Jenkins as Secretary and every Thursday afternoon six teams from Civil Engineering pound the pins of the Bowl-O-Drome. On Tuesday the Franklin League under H. B. Hansteen and W. H. Erickson takes the floor with eight teams; on Wednesday the Thurston League under the guidance of A. Dispenza takes over with eight teams; and on Fri-

(*Concluded on page* 38)

Perennial Athlete

(Concluded from page 36)

days the original Sibley League under L. L. Otto and E. R. Watt winds up the week's activities.

With one exception these leagues are and have been "handicap" leagues, allowing the lower average team of two opposing teams to add 75% of the difference between team averages to their score each game. In the Sibley League this year the abilities of the team members have become sufficiently well known, and the different teams sufficiently well balanced to adopt a no-handicap, or "scratch" league system.

In each of the leagues the method by which team personnel is chosen has been so devised as to cut across department and group lines, and to result in more evenly balanced teams. This was done purposely on the theory that "the other fellow isn't such a bad sort once you get to know him." It has worked out very well in breaking down excessive reserve between different departments and groups within each school, and in producing more appreciation of the other fellow's efforts and problems. The next step is the promotion of inter-school and inter-league matches to accomplish within the College of Engineering what is now underway within each school.

The Sibley and Thurston Leagues lost a loyal and enthusiastic member this fall with the death of Professor F. O. Ellenwood. He had taken up bowling at an age when most men are looking for less strenuous pastimes and had entered into the competition in both leagues with all the enthusiasm of a youngster. His devotion to the improvement of his game made him a formidable opponent, and many a younger and more agile bowler was soundly beaten by his accuracy and perseverance.

Chart of Averages

The chart accompanying this article illustrates the yearly change which the members of the Sibley League have been able to effect in their yearly cumulative averages. It is presented for comparison purposes for those alumni who can say of the faculty "I knew him when" and for the students who know his professional side now but may not be as well acquainted with his athletic prowess.

Alumni News

(Continued from page 23)

Karl J. Nelson ChemE '43, recording secretary of the Cornell Society of Engineers, is a chemical engineer with the Standard Oil Development Company.

The bequest of the residuary estate of the late Horace E. Sibson '03, who died last September, to be used by College of Engineering may total $300,000. The terms specify that the bequest "may be invested as an endowment fund, the income therefrom arising to be applied for any use of the College of Engineering; or the principal or any part thereof, may be applied towards the construction and permanent equipment of the new Materials and Metallurgical Laboratory or any other building for the use of the College of Engineering."

DU PONT *Digest*

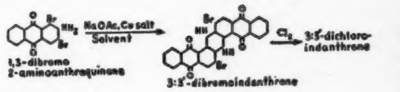
For Students of Science and Engineering

Development of dyes requires both physical and organic chemistry

The synthesis of a new dye in the laboratory or even the development of a manufacturing process from that synthesis may still be a long way from the realization of the full potentialities of the new compound as a coloring material. This is illustrated by the commercial history of the exceedingly fast bright blue dye indanthrone and its halogen derivatives.

Indanthrone was the first known anthraquinone vat dye and has led tonnage sales of vat dyes in the U.S. since its introduction, despite the commercial use of well over 200 types. In 1901, Bohn first synthesized indanthrone by KOH fusion of 2-aminoanthraquinone, but the yields obtained were in the range of only 25-30 per cent. Because of the industrial importance of indanthrone, and the low commercial yields obtained by the original fusion procedure, a great deal of research time has been spent in its study.

Several U.S. patents record the fact that Du Pont organic chemists have made outstanding contributions in this field, particularly by developing the intercondensation of 2 moles of 1,3-dibromo-2-aminoanthraquinone and replacing the bromine by chlorination to give 3:3′-dichloroindanthrone ("Ponsol" Blue).



This fixes the chlorine in the desired positions to give a product with greater bleach-fastness than indanthrone and minimizes extraneous substitution that always accompanies direct chlorination of indanthrone. The commercial yields of 3:3′-dichloroindanthrone now being obtained by Du Pont are markedly greater than those obtained by Bohn and his workers.

It is just as important, however, that a water-soluble dye be made in a physical form that gives optimum shade and working qualities, such as perfect dispersion, freedom from specks, rapid reducibility and storage stability. A significant Du Pont contribution to the production of vat dyes in optimum physical form is called "turbulent flow drowning." In this procedure, the color is dissolved in strong H_2SO_4 and then diluted by a large volume of water in a constricted tube. High turbulence is maintained during dilution and produces uniform dye particles.

In this development the work of physical chemists and physicists, aided by electron microscopy, ultra-centrifuging, infrared and ultra-violet spectrometry and other modern techniques, was of major importance.

One of the three wings of the Jackson Laboratory, where a large portion of the basic research on dyes is carried on. The new $1,000,000 addition on the right is nearing completion.

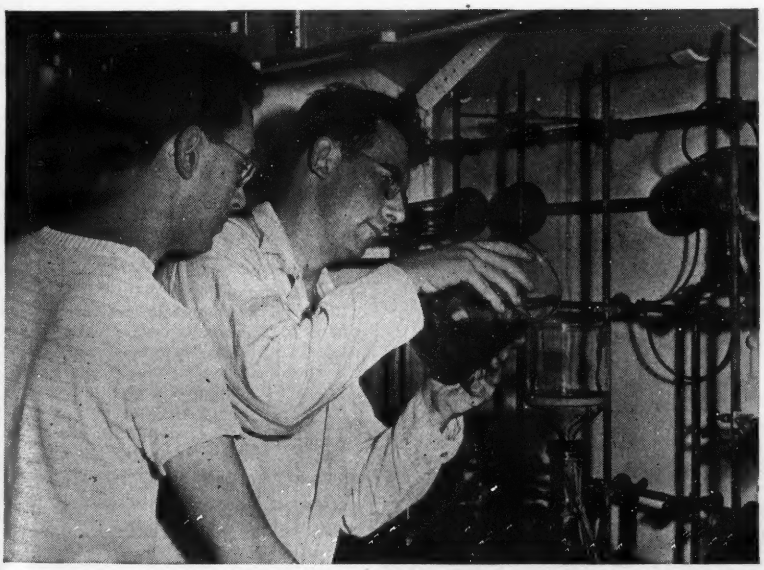
The conversion of laboratory findings to a plant operation often presents unique and difficult problems that require unusual ingenuity on the part of chemists, chemical, mechanical and electrical engineers. The work on the indanthrones was no exception. The outstanding commercial success of "Ponsol" vat colors, typified by "Ponsol" Blue is one example of the results achieved through cooperation of Du Pont scientists.

★ ★ ★

Questions College Men ask about working with Du Pont

WILL I GET LOST IN A BIG COMPANY?

The organization of Du Pont is unique in that each of its ten manufacturing departments and two technical staff departments is responsible for its own operation. Furthermore, new chemists and engineers work in small groups under experienced supervisors. Du Pont's group system assures men of interesting and friendly working conditions plus the broad avenues of promotion that go with size. Write for the new booklet, "The Du Pont Company and the College Graduate," 2521 Nemours Building, Wilmington 98, Delaware.



W. R. Remington, Ph.D., University of Chicago, 1944, and S. N. Boyd, Ph.D., University of Illinois, 1945, working on a dye research problem.

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

Aircraft Lab

(*Continued from page* 9)

Lec. 32. Turbine Engine Compressors.
Lec. 33. Contemporary Jet Engines.
Lec. 34. Contemporary Turbo-Prop Engines.
Lec. 35. Gas Burners and Combustors.
Lec. 36. Fuel Spray Nozzles and Controls.
Lec. 37. Fuel Pumping Equipment.
Lec. 38. Engine Compounding Principles.
Lec. 39. Free Piston Engines.
Lec. 40. Gas Turbine Performance.
Lec. 41. Ram Jets and Pulse Jets.
Lec. 42. Preliminary Examination III
Final Examination

3661—AIRCRAFT ENGINE DESIGN

credit 3 hours

Prerequisites 3581. 3337, 3660

This course is to be a detailed study of engine design principles; embracing pertinent thermodynamic calculations, and design of the several engine components to perform their mechanical functions and withstand the loads applied to them. It also will include a discussion of the aircraft engine industry, covering its engineering organization and procedure, engine development and testing methods, and manufacturing.

Problems bearing on the design of modern aircraft engines to meet particular specifications will be considered. A layout of an individual engine-design-project will be required from each student. Considerable outside preparation and problem work will be essential.

This course will serve as preparation for course 3663—Aircraft Engine Design—Advanced.

Topics to be covered by combined Lecture—Drawing Room sessions will be as follows:

PART I

Lec. 1. Aircraft Engine Design Methods, Industrial Procedures.
Lec. 2. The Aircraft Engine Manufacturing Industry, Organization.
Lec. 3. Engine Development and Testing Methods in Industry.
Lec. 4. The Place of the Young Engineer in the Engine Industry.
Lec. 5. Thermodynamic Aspects of Engine Design.
Lec. 6. Thermodynamic Considerations.
Lec. 7. Thermodynamic Calculations.
Lec. 8. Thermodynamic Calculations.
Lec. 9. Thermodynamic Calculations.
Lec. 10. Preliminary Examination I

PART II

Lec. 11. Piston Design Principles.
Lec. 12. Heat Transfer in Pistons.
Lec. 13. Special Problems in Piston Design.
Lec. 14. Piston Design.
Lec. 15. Piston Design.
Lec. 16. Connecting Rod Design Principles.

(*Continued on page* 42)

Aircraft Lab

(*Continued from page* 40)

Lec. 17. Connecting Rod Design.
Lec. 18. Crankchain Kinematics
Lec. 19. Crankchain Design
Lec. 20. Preliminary Examination II

PART III

Lec. 21. Crankshaft Design Principles
Lec. 22. Crankshaft Design.
Lec. 23. Crankshaft Design.
Lec. 24. Bearing Design Principles.
Lec. 25. Bearing Design.
Lec. 26. Crankcase Design Theory
Lec. 27. Crankcase Design.
Lec. 28. Cylinder Design Fundamentals.
Lec. 29. Cylinder Design Fundamentals.
Lec. 30. Final Examination.

3662—AIRCRAFT POWER-PLANTS LABORATORY

credit 2 hours

Prerequisites 3660

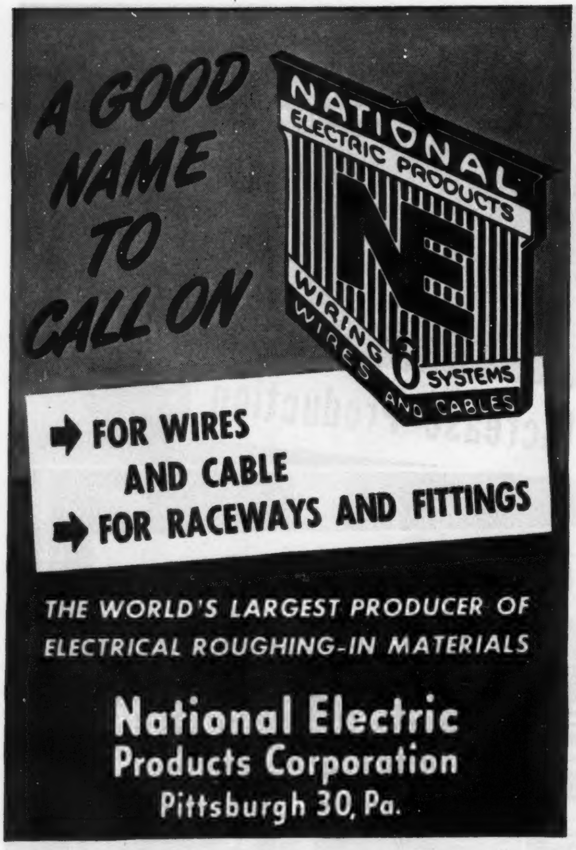
This course is to be a detailed study of experimental techniques and laboratory methods as they pertain to the development, manufacture, and testing of aircraft propulsion machinery.

Topics covered by the combined Lecture — Laboratory sessions will be as follows:

PART I

Lab. 1. Experimental Methods
Lab. 2. Engine Test Instrumentation and Calibration

(*Continued on page* 44)



Aircraft Lab

(*Continued from page 42*)

Lab. 3. Experimental Crankchain Analysis
Lab. 4. Contemporary Piston Engine Component Study
Lab. 5. Single Cylinder Performance Testing
Lab. 6. Air Cooled Engine Performance Testing
Lab. 7. Liquid Cooled Engine Heat Balance Testing
Preliminary Examination

PART II

Lab. 8. Accessory Testing
Lab. 9. Supercharger Performance Testing
Lab. 10. Contemporary Gas Turbine Component Study
Lab. 11. Fuel Injection System Calibration
Lab. 12. Jet Engine Static Testing
Lab. 13. Intercooling and Recuperator Study
Lab. 14. Dual Rotation Turbo-Prop Reduction Gear Testing
Final Examination

3663—AIRCRAFT ENGINE DESIGN—ADVANCED

credit 3 hours

Prerequisites 3661, 3662

This course will serve as a continuation of 3661 Aircraft Engine Design. It will augment the design of the principal engine components as covered in 3661 with a detailed design study of secondary engine components and the selection of accessory equipment.

Topics to be covered by combined Lecture-Drawing Room sessions will be as follows:

PART I

Lec. 1. Combustion Chamber Design
Lec. 2. Cylinder Valving Design
Lec. 3. Spark Plug and Hot-spot Location
Lec. 4. Air Induction, Scavenging, and Turbulance
Lec. 5. Supercharging Aspects
Lec. 6. Problems in Cylinder Cooling
Lec. 7. Fuel Injection Aspects
Lec. 8. Cylinder Layout
Lec. 9. Cylinder Layout
Lec. 10. Preliminary Examination I

PART II

Lec. 11. Air Induction Systems and Manifolding Design
Lec. 12. Intake and Exhaust Porting
Lec. 13. Valve Design
Lec. 14. Valve Gear Arrangement
Lec. 15. Valve Cam Design
Lec. 16. Reduction Gear Layout
Lec. 17. Contra Propellor Drives and Two-speed Mechanical Clutching
Lec. 18. Mechanical Supercharger Arrangement
Lec. 19. Accessory Drives Design
Lec. 20. Preliminary Examination II

PART III

Lec. 21. Magneto Selection and Ignition Harness Arrangement
Lec. 22. Carburetor Selection
Lec. 23. Fuel Injection System Arrangement
Lec. 24. Water Injection Design Aspects
Lec. 25. Starter and Generator Selection
Lec. 26. Accessories Arrangement
Lec. 27. Oil Pump and Scavenging Pump Selection
Lec. 28. Engine Control Devices and Instrumentation
Lec. 29. Engine Installation
Lec. 30. Final Examination

3664 AERONAUTICAL GAS TURBINES

credit 3 hours

Prerequisite 3663

This course will be a detailed study of aeronautical gas turbine design principles; embracing pertinent thermodynamic calculations and the design of several principal components to perform their mechanical functions and withstand the loads applied to them. It will also include an evaluation of the present status and future prospects of aeronautical turbine powerplants in the light of piston engine competition.

Problems bearing on the design of an aeronautical gas turbine power-plant to meet particular specifications are to be considered. The layout of an individual gas turbine design project will be required from each student. Consid-

(*Concluded on page 46*)

Aircraft Lab

(*Concluded from page* 44)

erable reference to the technical literature and outside preparation will be essential.

Topics to be covered by combined Lecture-Drawing Room sessions will be as follows:

PART I

Lec. 1. Contemporary Aeronautical Gas Turbines and Their Significance
Lec. 2. Present Status and Future Prospects
Lec. 3. Open-Cycle Gas Turbine Design Procedure
Lec. 4. Thermodynamic Calculations
Lec. 5. Thermodynamic Calculations
Lec. 6. Thermodynamic Calculations
Lec. 7. Compressor Design
Lec. 8. Compressor Design
Lec. 9. Compressor Design
Lec. 10. Preliminary Examination I

PART II

Lec. 11. Combustor Design Principles
Lec. 12. Combustor Design
Lec. 13. Combustor Design
Lec. 14. Nozzle Ring and Turbine Wheel Design Principles
Lec. 15. Turbine Design
Lec. 16. Turbine Design
Lec. 17. Tail Pipe Design
Lec. 18. Shaft Design and Rotor Balancing Procedure
Lec. 19. Bearing Design
Lec. 20. Preliminary Examination II

PART III

Lec. 21. Fuel Injection Valve Selection
Lec. 22. Ignition Apparatus, Flame Holders and Glow Plugs
Lec. 23. Fuel Pumps and Governor Selection
Lec. 24. Installation and Controls
Lec. 25. Turbo-Prop Reduction Gear Principles
Lec. 26. Engine Layout
Lec. 27. Engine Layout
Lec. 28. Engine Layout
Lec. 29. Engine Layout
Lec. 30. Final Examination

3665—EXPERIMENTAL PROJECTS

This course will consist of individual advanced study in the development, perfection, or application of aircraft propulsion machinery.

Experimental projects will be available to qualified upperclassmen or graduate students; qualification for such projects being determined on the basis of interview by the faculty attached to the Aircraft Powerplants Laboratory.

3666—AIRCRAFT POWERPLANTS SEMINAR

This course is to consist of several weekly lectures by visiting engineers prominent in the aircraft powerplants field.

Detailed preparation and reference to pertinent technical literature will be required of the students before each lecture.

STRESS *and* STRAIN...

Memo: Women Situation at Cornell . . . Never in the history of human endeavor have so many pursued so few with such futile results.

* * *

A patient of the asylum who had been certified cured was saying goodbye to the director of the institution. "And what are you going to do when you go out into the world?" asked the director.

"Well," said the ex-nut, "I have passed my bar examinations, so I may try to work up a law practice. Again, I had quite a bit of experience with dramatics in college, so I might try my hand at acting."

He paused and thought for a moment.

"Then, on the other hand," he continued, "I may be a teakettle."

"What's the hurry?"

"I bought a text-book and I'm trying to get to class before the next edition."

* * *

Garageman: "How did you happen to puncture the tire?"

Motorist: "I ran over a milk bottle."

Garageman: "Didn't you see it?"

Motorist: "No, the kid had it under his coat."

* * *

Counsel (to the police witness): "What if a man is on his hands and knees in the middle of the road; that does not prove he is drunk."

Policeman: "No, sir, it does not. But this one was trying to roll up the yellow traffic line."

". . . the proof is self-evident."

In the furnace room, Sammy, the janitor, sat writing a letter. The ashman came in.

Sammy's pencil moved with a snail-like pace across the paper.

"My goodness! You sure write slow," the ashman observed.

"Ah means to," replied Sammy. "My girl kain't read fast."

* * *

Wife (to husband reading Cornell Engineer): "Darling, don't you love me anymore?"

Husband: "Love you! Listen woman: I adore you, I worship you. I love you more than life itself. Now shut up and let me read my favorite magazine."

* * *

"I'm fed up on that," cried the baby, pointing to the high chair...

* * *

. . . A supersalesman is a fellow who can sell a Phi Beta Kappa professor a double breasted suit . . . He just got out of college and back to civilian clothes . . . Marriage is like a card game. It starts with a pair. He shows a diamond. She shows a flush—and they both end up with a full house . . .

* * *

Late to bed and early to rise
Makes a man saggy,
Draggy, and baggy
Under the eyes.

* * *

Brooklyn Sailor: "Whadja do before yer jerned da Navy?"

Mid Westerner: "I worked in Des Moines."

Brooklynite: "What kind of moines, iron or coal?"

* * *

Wishing you a happy . . . DROP DEAD.